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THE
AMERICAN NATURALIST.

VOL. XXI. DECEMBER, 1887. No. 12.

HOW THE GREAT NORTHERN SEA-COW (RYTINA) BECAME EXTERMINATED.

BY LEONHARD STEJNEGER.

THE conclusions in regard to the extermination of the Great Northern Sea-Cow (*Rytina gigas*) and the causes which led to it, arrived at by the Russian naturalists, Von Baer and Brandt, and by them discussed in numerous publications, were regarded as final, and were generally accepted, until Prof. A. E. Nordenskiöld recently made the startling announcement that, during his five days' stay at Bering Island with the "Vega," *he discovered incontrovertible evidence that at least one sea-cow had survived the general slaughter, and had been seen alive as late as 1854*, or more than eighty years after the last one was supposed to have been killed. This statement of Professor Nordenskiöld was based upon his interpretation of an account of a strange sea-animal which two Bering islanders claimed to have seen some time previously. Nordenskiöld gave no details to speak of, merely asserting that the description of the animal by the natives tallied so completely with Steller's description of the sea-cow as to leave no doubt that they had really seen a living Rytina; but, notwithstanding this meagreness of the account, the weight of Nordenskiöld's name was then so great that his assertion would probably have been generally accepted. It was my good fortune to spend a year and a half on Bering Island three years after Nordenskiöld's visit, and, as the readers of the "Proceedings of the United States National Museum"[1] know, I succeeded in bringing to light a number of facts which

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[1] Vol. vii., 1884, pp. 181–189.

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prove conclusively—as I have published even the minutest details, any one can make up his mind as to the weight of the evidence—that the animal seen by the men was *not* a sea-cow, but that, in all probability, it was a stray female narwhal. To this Nordenskiöld has had no other reply than a reprint of his former assertion, without even an attempt to give any further details or to refute my arguments. The only new point in his answer is an effort to throw discredit on the accuracy of Sauer's "Account of Billing's Expedition in the Years 1785 to 1794," in which Sauer expressly states that the last sea-cow was killed at Bering Island in 1768, twenty-seven years after the island had been discovered by man. In a paper published in the *Bulletin of the American Geographical Society*[1] I have already been able to vindicate Sauer. In the present paper I shall, therefore, only try to demonstrate how easy it is to account for the rapid extermination of this huge animal, if we take all the known facts into consideration. To any one familiar with the literature on the subject such an undertaking might be supposed to be superfluous, so well has the task been performed long ago by the great Russian scientists already referred to; but I may perhaps be able to elucidate the subject a little further,—a labor apparently not quite unnecessary, in view of the following remarkable statement of Professor Nordenskiöld (*Bull. Amer. Geogr. Soc.*, 1885, p. 281): "It cannot very well be supposed that in a sea so rarely visited in the last century as the northern part of the Pacific Ocean the last specimen of the genus Rytina should have been slain by the harpoon of the hunter. I even imagine that the hardly accessible coasts of Bering and Copper Islands have been very rarely visited by hunters since Steller's day, 1741." As will be seen from the following pages, there was no need of "imagining" anything of the kind, when the facts, as related in the literature, so amply prove the contrary.

As everybody knows, Bering and his unfortunate comrades, among them the immortal Steller, in the autumn of 1741, discovered the then uninhabited island which afterwards received its name from Bering, who died there shortly after. The survivors of the expedition wintered on that island, and when they landed there they saw the first living sea-cows (Rytina) ever beheld by white men.

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[1] 1886, No. 4, pp. 317-328.

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Unfortunately, Steller, in describing this animal and its habits, only says that he found it numerous and in herds, without stating exactly how numerous or in how large herds. We are thus left to guess at their probable number when first found; and from what he says in regard to their habits and the places they frequented, and from what I know of the natural conditions of the island, I should regard fifteen hundred as rather above than below the probable number. It must be remembered that the sea-cow was an extremely bulky animal, twenty-four to thirty feet long, which lived chiefly near the mouths of the rivulets, feeding on the sea-weeds, especially the large Lamellarias. There are hardly more than fifteen places on the island which could afford them suitable grazing-grounds, and if each of these were regularly visited by an average of one hundred animals, one would easily be impressed by their number, especially if divided up into five to ten herds of from ten to twenty individuals.

There can hardly be any doubt that these animals were the last survivors of a once more numerous and more widely distributed species, which had been spared to that late date because man had not yet reached their last resort. It is, then, pretty safe to assume that this colony was not on the increase, and that, under the most favorable circumstances, the number of surviving young ones barely balanced the number of deaths caused by the dangers of the long winters. Under this supposition, every animal killed by a new agency—in this case by man—represents one less in the total number.

No sooner did the survivors of Bering's expedition return to Kamtschatka, in 1742, than hunting expeditions were fitted out; for already, in 1743–1744, we find Bassoff and his crew wintering on Bering Island, and from that year and until 1763 hardly a winter passed without one or more parties spending eight or nine months in hunting fur-animals there, during which time the crews lived almost exclusively on the meat of the sea-cow. But that is not all, for more than half of the expeditions which wintered there did so for the express purpose of laying in stores of sea-cow meat for their farther journey, which usually lasted two to three years more.

In order to substantiate the above assertion, I shall give a detailed list of the expeditions which are *known* to have wintered on Bering Island during the twenty years in question. The old

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records are very defective, and it is extremely probable that many more of the expeditions which left Kamtschatka in order to hunt and trade on the Aleutian Islands and in America stopped at Bering Island, as was the usual custom; but we shall only enumerate those of which the records expressly say that they wintered there. The number of men employed on the vessels is not given in all instances, but, as it varies between thirty and fifty, I have estimated it to be thirty in most cases of which we have no definite record. In the few instances in which the length of time spent on the island is not given I have estimated it to be eight months, which is shorter than the shortest time actually recorded:

Winter.	Name of Owner or Captain of Vessel.	Men.	Months.	Remarks.
1743–1744	Basoff	(30)	(8)	Numbers in parentheses estimated.
1745–1746	Basoff	(30)	12	Months, only approximate figures.
1747–1748	Kholodiloff	50	9	There is some uncertainty about the time Yugoff spent on Bering Island. He is said to have wintered from 1751 to 1754 on Bering and Copper Islands,—about thirty-two months. It is not probable that he spent less than half of this time on Bering Island.
1748–1749	Bakhoff	(30)	11	
1749–1750	Tolstykh	50	8½	
1751–1752	Yugoff	26	(16)	
1752–1753				
1753–1754	Kholodiloff	34	10	
1754–1755	Drushinin	(30)	(8)	
1754–1755	Durneff	(40)	(8)	
1754–1755	Krassilnikoff	(30)	9½	
1754–1755	Jakovleff	33	(6)	These four men belonging to Drushinin's crew were left behind.
1755–1756		4		
1756–1757	Krassilnikoff	(34)	(8)	Krassilnikoff's crew and four of Drushinin's.
1756–1757	Tolstykh	38	9	
1757–1758	Shilkin	39	(8)	
1758–1759	Palkoff	45	9½	
1760–1761	Tolstykh	(38)	8½	
1762–1763	Korovin	45	9½	
1762–1763	Medvedeff	45	(9)	

It will be seen that there wintered in 1754 to 1755 about one hundred and thirty-three men, and in 1762 to 1763, ninety men.

In addition to the above, we know of a number of expeditions wintering on Copper Island, and many more which passed by the Commander Islands on their way east. Besides, how many were there of which we know nothing? And yet Professor Nordenskiöld imagines that these islands "have been very rarely visited by hunters since Steller's day,—1741"!

Some of the records in regard to the above expeditions are

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very interesting as having a direct bearing on the question before us. Thus, it is said, *à propos* of Krassilnikoff's wintering on Bering Island, that "it had already become customary for all vessels intending to hunt sea-otters on the more distant islands to winter there [Bering Island] in order to provide sufficient stores of the meat of the sea-cows (*Manati*)." These expeditions lasted usually three to four years, and it is safe to assume that they laid in provision for not less than twelve months. Of the expeditions enumerated in the above list, ten, with an aggregate of about four hundred men, belong to this category.

Still more valuable are the details which have been recorded in regard to Jakovleff's expedition. He was a mining engineer, consequently a man of education and intelligence, as his reports also testify, sent out by the Russian government in order to investigate the alleged occurrence of native copper on Copper Island. The records show, beyond dispute, that when this island was first visited (1745 to 1746) sea-cows occurred along its beaches (and I myself have found remains of them on that island); but in 1754, when Jakovleff was to explore Copper Island, he was obliged to winter on Bering Island, *because at that early date, nine years after the first visit, the sea-cows had been extirpated on Copper Island by man!*

Including his crew, there wintered that year, on Bering Island, hardly less than one hundred and thirty-three men, one of the chief occupations of whom it was to procure, during eight months, as much sea-cow meat for their future expeditions as they possibly could. This was done regularly by harpooning the animal from a boat manned with eight oarsmen, and when killed it was immediately towed to the shore to be hauled up on the beach and cut up at once, as the meat would spoil if left unattended until the next day. This was the method for securing provisions for the vessels, but a much more wasteful manner was pursued in killing the animals which served as food for the hunters during their sojourn on the island. From Jakovleff's diary we learn that the hunters were scattered all over the northern (*i.e.*, northern and eastern) shore of the island by twos and threes for the sake of catching foxes and other fur-animals, while sea-cow meat was the only food available.[1] These

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[1] It is even probable that Jakovleff refers to a more or less regular population of hunters, in addition to the crews of the wintering vessels.

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men, in order to obtain food, had to secure their sea-cow single-handed, and whenever they got an opportunity—what they often did—they would sneak up to an animal lying close to the shore or in shallow water, and wound it mortally by thrusting the iron-shod pole into it. The animal, which was hardly ever killed outright, sought the high sea and died there. If it drifted ashore the same day, well and good; but in most cases it came in unfit to be eaten, if it was not carried away altogether. So impressed was Jakovleff with the extreme wastefulness of this method that he predicted the speedy extermination of the sea-cow unless some precautions be taken against this senseless slaughter; and when, in 1755, he returned to Kamtschatka, he presented a petition to the authorities there that it be prohibited by an ukas to kill sea-cows in this manner, "in order that Bering Island may not be devastated in the same manner as Copper Island." Of course, nobody heeded this eminently wise suggestion, and the result became as he had predicted it: the last sea-cow was killed within thirteen years.

Can anybody who contemplates the fact that the sea-cow was an exceedingly stationary animal, which was bound to the kelp-fields near shore; that it was extremely stupid and sluggish; that it was deprived of the faculty of diving; and that the island offers absolutely no shelter or concealment for it,—can anybody, after having read Jakovleff's report and petition, possibly entertain a doubt that the last specimen of the genus Rytina was slain by the harpoon of the hunter?

But let us attempt a calculation, based upon the former guess as to the original number of living sea-cows when Bering Island was first visited, and upon the facts as they have been presented above. Before doing so we will have to estimate the number of animals wastefully slaughtered, and from the statements made by Jakovleff I should think it no exaggeration to say that there were killed five times as many animals as were actually utilized. From Jakovleff's report we learn that one sea-cow would furnish food sufficient for thirty-three men during a whole month, and, although it is probable that he made his party utilize each animal in a higher degree than the other hunters, we shall take the above figures as indicating the average. It will be seen that we do not take into account Burdukovski's statement, that only the kidneys were eaten, for he only had his knowledge from hearsay.

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while from Jakovleff's diary it seems evident that all the meat was eaten. This is an additional reason why no weight should be attached to the rest of Burdukovski's story.

Now, to supply the six hundred and seventy men which we know wintered on Bering Island between 1743 and 1763, during an average time of ten months, it required, in round figures, about two hundred and five animals. According to the same method of calculation, we find that the four hundred men who laid in provisions for protracted journeys would require about two hundred and ninety animals for an average time of twenty-four months,—together, four hundred and ninety-five animals. If five times as many cows were wantonly killed as were utilized, we have a grand total of two thousand four hundred and seventy-five sea-cows slaughtered up to the year 1763, or nearly one thousand in excess of our estimate of the original number. We can therefore either admit that there were more than two thousand living sea-cows when Steller discovered them, or else that only twice as many animals were wasted as were properly utilized; but, whatever conclusion we choose, it is manifest that our estimates have been very reasonable.

From 1763 the visits to Bering Island seem to grow scarcer; at least, the records contain nothing definite that I am aware. This is probably due to the very fact that sea-cows had now become so nearly exterminated that the few left were insufficient to maintain any wintering and foraging expedition, while, at the same time, the fur-bearing animals were also so badly decimated that it would not pay for a large party to hunt them. The smaller animals, as we know, would recuperate when left undisturbed for a few years, and it was probably by a party who went out to Bering Island in 1767 or 1768—possibly on one of Popoff's vessels—in order to catch blue foxes that the last sea-cow was mercilessly killed. Four years after, in 1772, Dmitri Bragin again wintered on Bering Island, and, from the fact that in the list he gave of the animals of the island he omitted the sea-cow, it is reasonably safe to conclude that not one was left to be recorded by him.

After all, there is nothing surprising in the speedy extermination of this clumsy animal, which could not dive, and which had actually no means of defence or escape. It is too well known that it did not emigrate, and the theory that it was driven off to other places is not only directly disproved, but is quite unnecessary in order to explain the sudden disappearance of the Great Northern Sea-Cow from the shores where it was first discovered.

I think it will be admitted that we have succeeded in materially strengthening Sauer's assertion, that the Rytina was exterminated in 1768, and that the above is a fair exposé of the causes which led to its final extirpation. It was simply due to man's greed, and he accomplished it within the short time of twenty-seven years.

THE MATERIALS OF THE APPALACHIANS.

BY E. W. CLAYPOLE.

(Concluded from page 962.)

THE FOUR GREAT SANDSTONES OF PENNSYLVANIA.

IN the former part of this paper I dwelt on the fact of the existence of several thick sandstones and quartz conglomerates in the massive palæozoic deposits of Pennsylvania. I further showed that these rocks indicate a supply of quartz far greater than could be furnished from any existing source; and, thirdly, that the nature of this quartz is such that the only known origin for it is the quartz-ledges of the South Mountains. Hence I inferred the former extension of these strata over a greater extent of country than at present.

In this second part I propose to try and give a more definite shape to this conclusion, and to at least suggest where and when this palæozoic land existed.

Excluding, for various reasons which it is not necessary here to mention, the Potsdam Sandstone, there remain four great sheets of sandstone, more or less conglomeratic, in the immensely thick palæozoic deposits of the Eastern States. Between them there lie massive, softer deposits of shale and limestone. In descending order these beds are as follows, omitting all minor and insignificant layers:

		Feet.
	Shale, coal, sandstone	Variable.
4	Sandstone and pebbles (Pottsville Conglomerate)	1500
	Shale (Mauch Chunk)	1500
3	Sandstone and pebbles (Pocono Conglomerate)	2000
	Sandstone and pebbles (Catskill Sandstone)	6000

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Sea Cow Family Reunion

A paleontologist finds the missing link in the lineage of a fantastic marine mammal

by Daryl P. Domning

The evolutionary history of the Sirenia, the order of plant-eating marine mammals that includes the manatee and dugong, has intrigued me since my high-school days nearly twenty-five years ago. While still an undergraduate, I dedicated my research career to understanding their extensive but fragmentary fossil record. I also learned in those days of another kind of sirenian—popularly known as Steller's sea cow—that became extinct more than two centuries ago. This animal was even stranger than its odd living relatives, the manatees and dugongs, and its strange story matched its peculiar characteristics.

Early in November of 1741, the Russian brig *Saint Peter* was searching her way along the bleak chain of islands now known as the Aleutians, her demoralized and scurvy-ridden crew hoping to regain their base at Petropavlovsk before the onset of the fast-approaching winter storms. They had been the first Europeans to set foot in Alaska, but little else had gone right with Vitus Bering's second voyage of exploration of the seas between Asia and North America, and now the captain commander himself lay in his cabin near death. The crew's hopes of quick relief were abruptly ended when they were shipwrecked on an unknown and uninhabited island in this northern sea that, along with the island, was later to be named Bering after their dead leader.

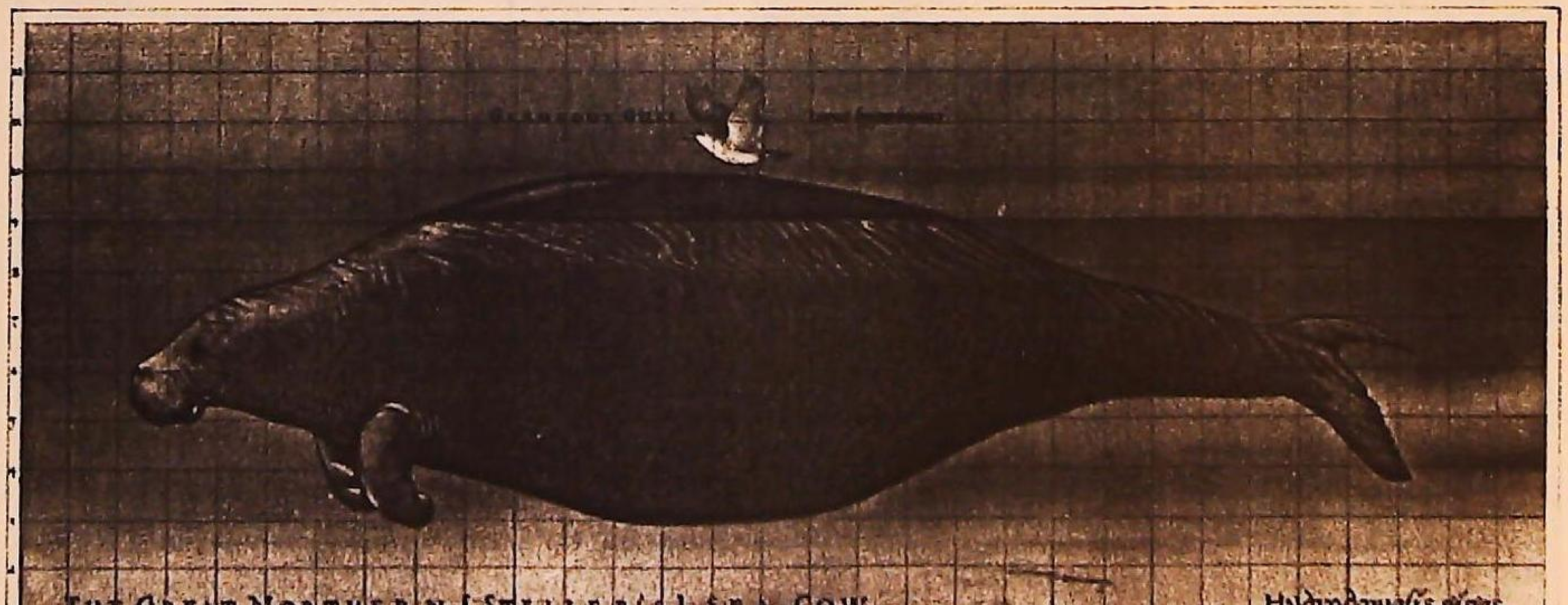
The island was devoid of humans but not of life—fortunately for the crew who would have to endure the bitter winter before building an escape vessel from the wreckage of their ship. When the survivors reached safety in Kamchatka the next summer, the ship's naturalist, Georg Wilhelm Steller, reported, among other notable discoveries, that Bering Island was surrounded by herds of huge sea cows feeding on kelps in the shallow water. From his past reading, Steller recognized the animals as sirenians. But he also realized they were no ordinary sea cows.

These animals lived in the frigid water of subarctic latitudes, whereas the manatees of which he had read lived in tropical waters. In addition, these arctic sea cows reached lengths of twenty-five feet, nearly twice the size of the tropical sea cows. They had a thick, rough, barklike epidermis and were completely toothless, having only the horny pads at the front of their jaws that all sirenians use to mash their food. They were unique among vertebrates above the level of lobe-finned fishes in having no finger bones in their short, clawlike flippers. Perhaps strangest of all, and unlike any other marine vertebrate, they seldom or never submerged themselves completely but habitually floated with their backs out of the water.

Fortunately for Steller and his shipwrecked companions, but unfortunately for the animals, these sea cows were very good to eat. Only some 2,000 sea cows existed in the vicinity of Bering Island in 1741, and within twenty-seven years Russian fur hunters had eaten them to extinction. As a result, later scientists knew Steller's sea cow only from descriptions by Steller and a handful of other explorers and from incomplete skeletons dug from the beaches of Bering Island in the nineteenth century.

All this I knew by the time I began my graduate work in paleontology at the University of California at Berkeley in 1968. I also knew that, despite the rather extensive fossil record of the sirenian family Dugongidae, to which Steller's sea cow belongs, there were no known fossils connecting the bizarre animal of Bering Island, *Hydrodamalis gigas*, with other members of the family.

At the time, paleontologists thought that *Hydrodamalis* was probably derived from Miocene Atlantic sea cows belonging or related to the genus *Metaxyther-*


THE GREAT NORTHERN [STELLER'S] SEA COW
Hydrodamalis gigas
SCALE: one-half inch equals one foot.

Dugald Stermer

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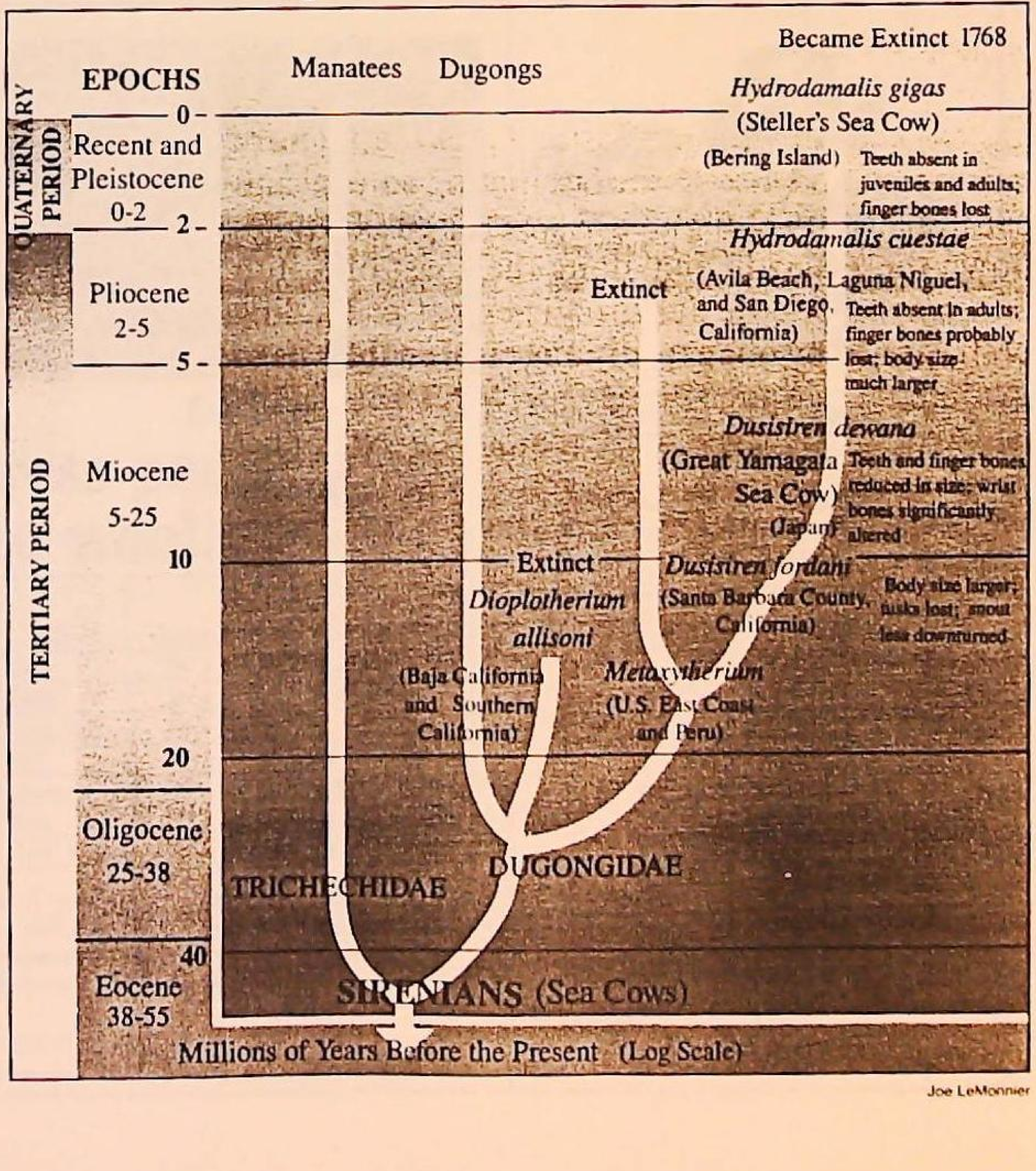
ium. The latter had also apparently once lived in the North Pacific; a fragmentary specimen had been reported in 1925 from late Miocene rocks (about ten to twelve million years old) in southern California's Santa Barbara County and named *Metaxytherium jordani.* Nevertheless, according to the late paleontologist George Gaylord Simpson, neither that form nor any other species of the family Dugongidae showed "a definite foreshadowing of the specializations of *Hydrodamalis,*" by which he meant their enormous size, strange flippers, and lack of teeth.

This view began to change in the 1960s as a result of discoveries in California of several better-preserved late Miocene specimens of *M. jordani.* These specimens differed so greatly from any of the Atlantic and Mediterranean fossil sirenians bearing the name *Metaxytherium* that I put this species in a new genus, *Dusisiren* ("siren of the west").

The new specimens of *Dusisiren jordani* showed close ties to Steller's sea cow. In the latter, the edge of the bone at the rear of the skull was greatly enlarged and roughened for the attachment of powerful neck muscles. Alone among fossil sea cows, *Dusisiren* showed a similar though lesser development of this area, as well as other important resemblances in the functional design of the neck region. Furthermore, the cheek teeth of individuals varied considerably in size. This would be expected if teeth were no longer essential to the animals' survival. An immediate ancestor of the toothless Steller's sea cow probably would have had smaller teeth. But this was not enough to demonstrate a direct ancestor–descendant relationship with Steller's sea cow. For a form to have been a direct ancestor it had to have existed prior to the descendant and to have lived in an area accessible to an area occupied by the descendant. In addition, if the ancestor's structure differs greatly from the descendant's, then forms intermediate in structure and dates of existence must be found in order to show the course of evolution. Finally, the case for direct descent is greatly strengthened if changes in form can be explained as functional adaptations to changes in ancient environments.

In the case of the North Pacific sea cows, several of these criteria had been met. Of all known sirenians *Dusisiren jordani* was by far the closest relative and best structural ancestor for *Hydrodamalis;* it lived on the coasts of the North Pacific, and it antedated Steller's sea cow

Simplified Sirenian Family Tree


Became Extinct 1768
EPOCHS
Manatees
Dugongs
Hydrodamalis gigas
(Steller's Sea Cow)
QUATERNARY PERIOD
0
Recent and Pleistocene 0-2
(Bering Island)
Teeth absent in juveniles and adults; finger bones lost
2
Hydrodamalis cuestae
Extinct
(Avila Beach, Laguna Niguel, and San Diego, California)
Teeth absent in adults; finger bones probably lost; body size much larger
Pliocene 2-5
5
Dusisiren dewana
(Great Yamagata Sea Cow) (Japan)
Teeth and finger bones reduced in size; wrist bones significantly altered
TERTIARY PERIOD
Miocene 5-25
10
Extinct
Dioplotherium allisoni
(Baja California and Southern California)
Dusisiren jordani
(Santa Barbara County, California)
Body size larger; tusks lost; snout less downturned
Metaxytherium
(U.S. East Coast and Peru)
20
Oligocene 25-38
TRICHECHIDAE
DUGONGIDAE
40
Eocene 38-55
SIRENIANS (Sea Cows)
Millions of Years Before the Present (Log Scale)

Joe LeMonnier

by some ten million years. But actual links between them were still missing.

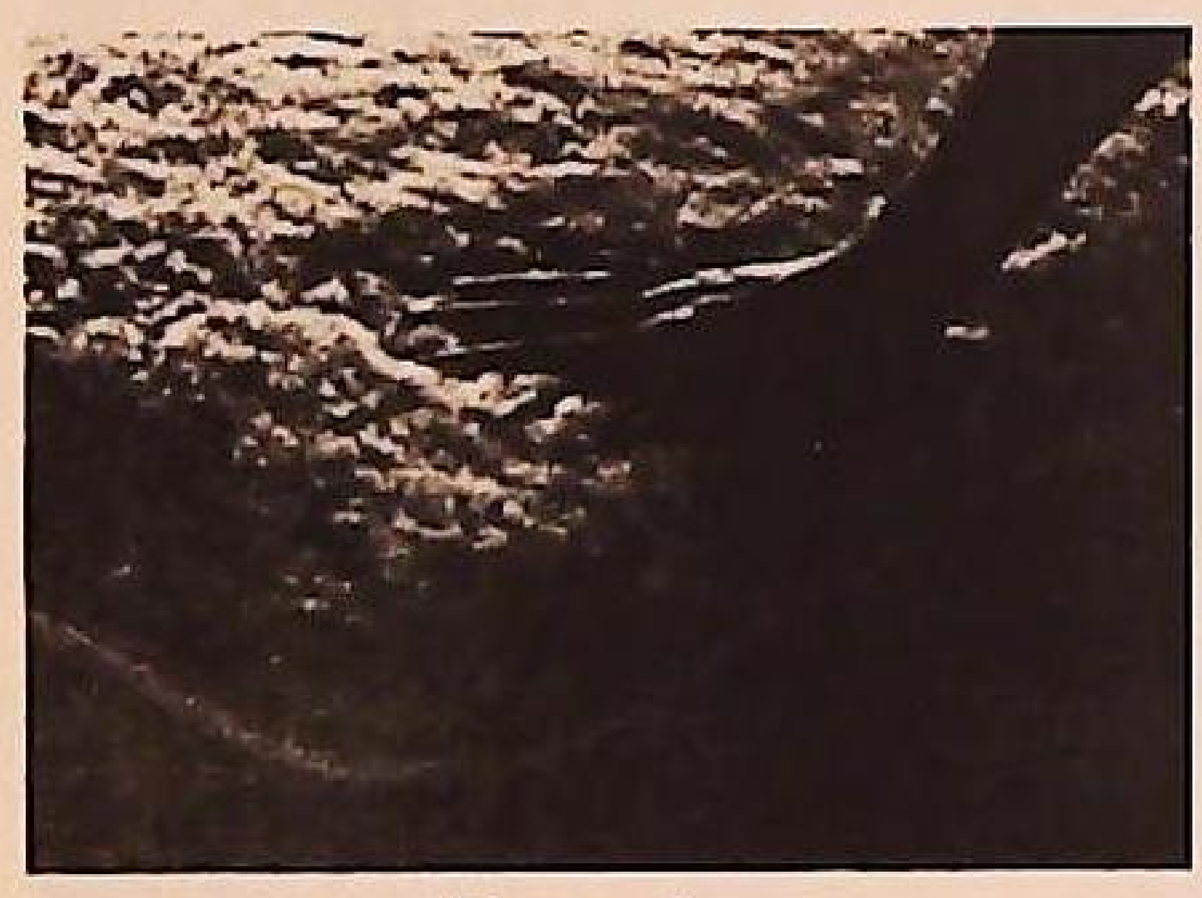
This situation changed suddenly when I learned of a skull of late Miocene or Pliocene age that the Natural History Museum of Los Angeles County had salvaged in 1966 from a construction site at Laguna Niguel, south of Los Angeles. Its well-preserved palate showed no trace of tooth sockets. Here was the first known *Hydrodamalis* from Tertiary rocks, but it was of unprecedented size. Although the whole posterior portion of the skull had been destroyed by the earthmover, the part that remained was longer than any complete Steller's sea cow skull known, and it must have belonged to an animal well over thirty feet long. This paleontological find was puzzling. If it represented an ancestor of the Recent Steller's sea cow, did that not indicate that the descendants of *Dusisiren* must have first doubled in length and then gotten smaller?

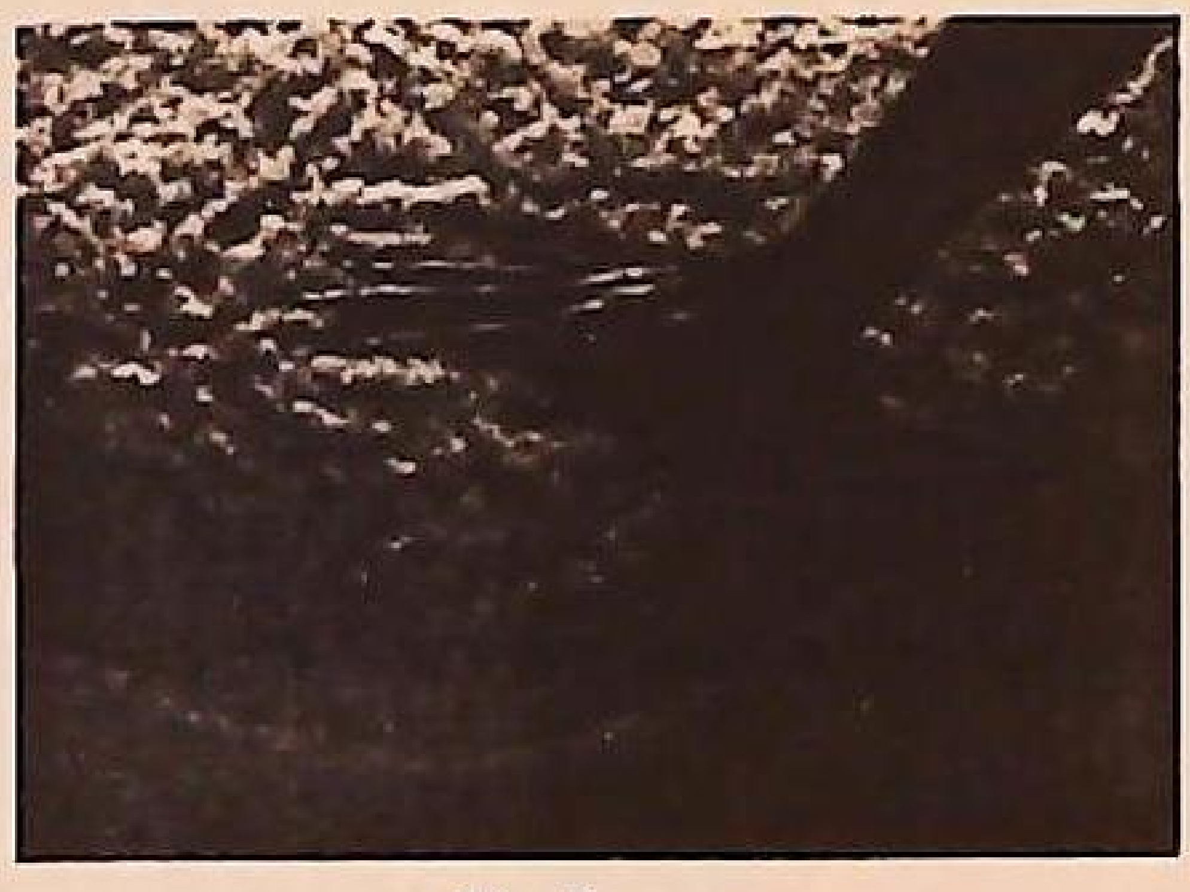
Closer consideration showed that this conclusion did not necessarily follow. Virtually all the remains of Steller's sea cows in the world's museums came from Bering Island. And Steller had written that the Bering Sea winter was hard, even on the sea cows; so hard that by spring their ribs had begun to show through their thick hides. Evidently, the Bering Island habitat was not optimal but marginal and might have resulted in stunted growth in this subarctic population, while more fortunate animals in southern California might have attained their full potential size.

More importantly, this Miocene-Pliocene sea cow, perhaps three to seven million years old, proved to be intermediate between *Dusisiren* and Steller's sea cow in the details of its anatomy. In its lack of teeth, it agreed with the latter, but the portion of its upper jawbone that had once held developing teeth was not as atrophied as in Steller's sea cow, and there were details of the snout, cheekbone, and frontal bone that clearly recalled the Miocene *Dusisiren*.

Not long after the discovery of the Laguna Niguel skull, the widening of a seaside road at Avila Beach, near San Luis Obispo, California, unearthed the skeleton of a large marine mammal. Thought at first to be that of a whale, on further examination the skeleton was recognized as that of a toothless sirenian. Eventually a colleague called this specimen to my attention, and a quick trip to San Luis Obispo confirmed what I had hoped for—the skeleton was another Pliocene *Hydrodamalis*, but much more complete than the one found at Laguna Niguel. And it provided striking evidence of its descent. Again, the toothless palate and other features were unmistakably like those of Steller's sea cow, but the braincase (missing from the Laguna Niguel specimen) was almost identical to that of *Dusisiren*. Throughout the skeleton there was a nearly equal mixture of morphological characteristics seen in the Miocene and the Recent Bering Island forms, vividly exemplifying the phenomenon of "mosaic evolution"—the occurrence of primitive and advanced characteristics in the same species. This presumably results from stronger selection for change in some organs than in others. I named this intermediate Pliocene form *Hydrodamalis cuestae* in honor of the faculty and students of Cuesta College, near San Luis Obispo, who excavated it.

In time, other isolated bones of *Dusisiren* and *Hydrodamalis* from California and Baja California were collected or identified in museum collections, filling in more details of the evolutionary picture. These included a partial skull of *H. cuestae* from San Diego even larger than the one from Laguna Niguel. Paleontologist Tom Deméré at the San Diego Natural History Museum invited me to join





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him in studying this and other specimens. Another interesting item was a large rib, clearly of *Hydrodamalis*, that had been found in Japan and brought to my attention. Of late Pliocene age, it was the first record of fossil sirenians in the northwest Pacific. The available fossils seemed to indicate that the ancestors of Steller's sea cow had evolved in the eastern Pacific and dispersed to Asia around the northern rim of the ocean after the animals developed a tolerance for cold climates.

Light was also thrown on the earlier end of the lineage between *Dusisiren* and Steller's sea cow. Christian de Muizon, a researcher at the Muséum National d'Histoire Naturelle in Paris, excavating in early and middle Miocene rocks of Peru, discovered remains of a sea cow belonging to a species of *Metaxytherium* known from beds of similar age on the east coast of the United States. In Miocene times, before the creation of the Central American land bridge, the same species of sirenian clearly lived along the eastern coast of the United States south of what is now New Jersey, in the Caribbean, and in the eastern Pacific; and those members of this species that spread north to California probably gave rise to *Dusisiren*.

So far a coherent picture had taken shape: a neat sequence of skeletal stages stretched from the early Miocene *Metaxytherium* found in Peru through the late Miocene *Dusisiren jordani* and the Miocene-Pliocene *Hydrodamalis cuestae* found in California to the Recent Steller's sea cow from Bering Island. Yet an important link was still missing from this chain. *D. jordani* was a fully normal sea cow, meaning it had functional teeth and a paddlelike flipper containing finger bones. The Avila Beach species, however, already stood (or floated) firmly in the camp of Steller's sea cow, lacking teeth as an adult and apparently having a hooklike forelimb. Almost no fossil evidence bridged the gap between these two very different kinds of animal. In a 1977 journal article, I went out on a limb and speculated about the structure of the still-undiscovered intermediate form. I referred to it as *Dusisiren* Species D, and predicted that it would have teeth like its ancestor *D. jordani*, but would have a forelimb like that of Steller's sea cow and would be found in eight- or nine-million-year-old rocks of the North Pacific region.

That was a risky hypothesis in several respects. It took the fossil record at face value, assuming that Steller's sea cow had not branched off from *Dusisiren* at some time much earlier in the Miocene epoch, before ten or twelve million years ago. It assumed, instead, that the lineage of Steller's sea cow had not branched at all, but consisted of a simple temporal sequence of species, one evolving into the next, over nearly twenty million years. That was the simplest explanation of the available data—but evolution does not always take the simplest route.

Very soon, however, this explanation was strikingly confirmed. The summer of 1978 was a dry one in northern Japan, and the Mogami River, north of Tokyo, was reduced to a fraction of its normal volume as it flowed through the countryside of Yamagata Prefecture. Two schoolboys exploring the exposed riverbed were surprised to see a series of large ribs and vertebrae protruding from the rocks. In the following weeks, an excavating team led by Shizuo Takahashi of the Yamagata Prefectural Museum uncovered most of a skeleton, including skull and forelimbs, of a late Miocene sirenian. Consulted about this skeleton, I was able to determine from photographs and some of the animal's teeth that it was an advanced form of *Dusisiren* and almost certainly, judging from its forelimb, was *Dusisiren* Species D, the creature whose existence I had pre-

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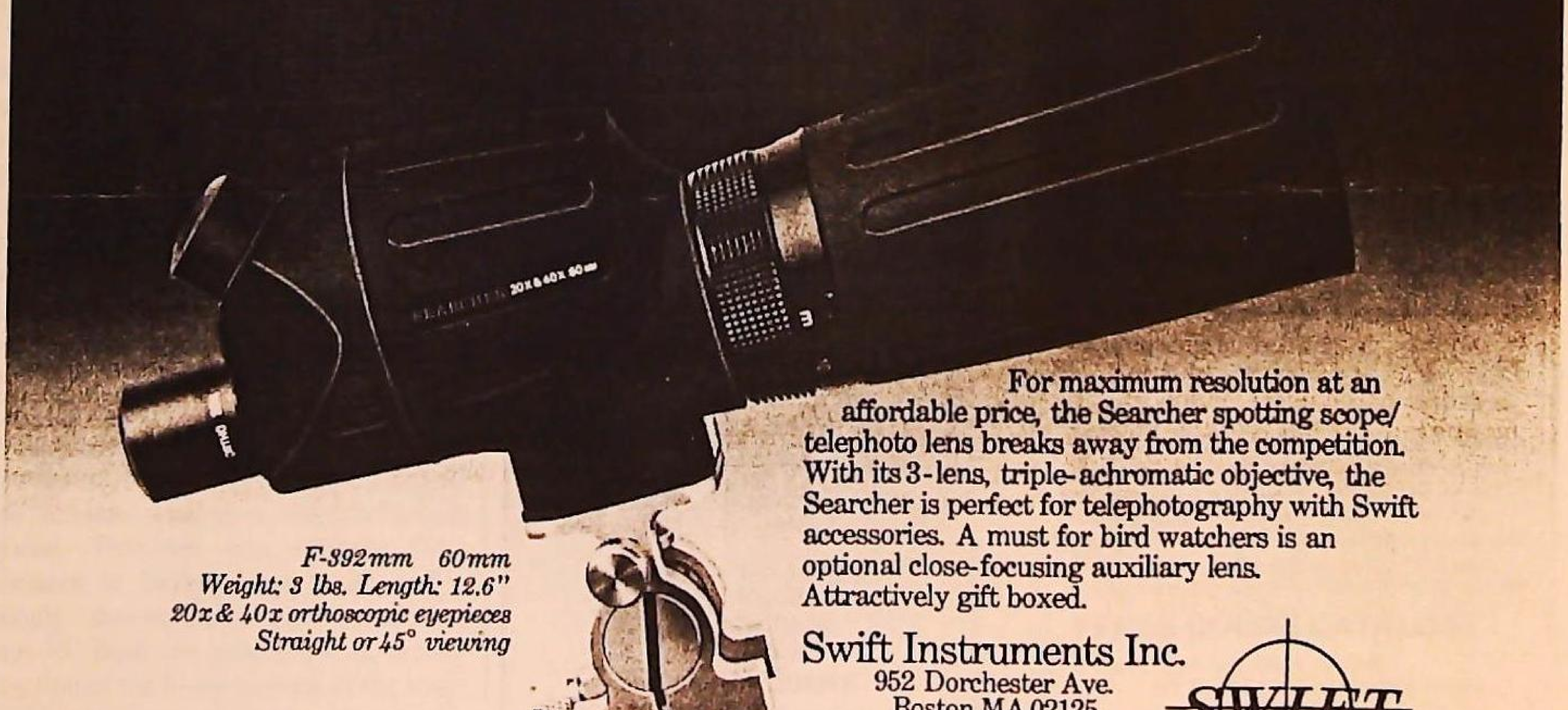

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dicted. The discovery caused a minor sensation in the Japanese press, which christened the beast Yamagata Dai Kaigyu—the Great Yamagata Sea Cow.

Through the generosity of the Yamagata Prefectural Museum I was able to travel to Japan in the summer of 1982 and study the skeleton at firsthand. By then its preparation was well advanced and showed that it was as perfect an intermediate between *Dusisiren jordani* and the species found at Avila Beach as the latter had been between *Dusisiren* and Steller's sea cow. Its skull was relatively primitive and contained a full set of teeth, but they were smaller and simpler than those of *D. jordani*. Its well-preserved forelimb, however, was pure Steller's sea cow: the abbreviated and clawlike hand skeleton, with its vestigial finger bones, seemed grotesquely out of proportion to the powerful upper parts of the limb. The wrist bones were ingeniously modified to lock together in mutual support when the animal used its flippers to pull itself along the rocky sea floor. For the first time, an actual specimen substantiated Steller's sometimes-doubted observations—and incidentally fulfilled my own predictions nicely.

Dated by means of microscopic diatoms fossilized in nearby rocks, the Yamagata sea cow turned out to be between 9 and 10.4 million years old, exactly intermediate between *D. jordani* and *H. cuestae* in age as well as morphology. Paleontologist Tsunemasi Saito, Takahashi, and I named it *Dusisiren dewana*, after Dewa, the ancient name of the Yamagata district. The final and most dramatic missing link in the evolution of Steller's sea cow had been found.

The establishment of an evolutionary line of descent, however, is not the ultimate goal of the paleontologist; the really interesting questions only begin to arise at that point. Why does one kind of animal evolve into another? What forces of natural selection could account for the changes observed? These problems require paleontologists to look beyond the lineage in question and examine the biological and physical context of its evolution.

The family branch to which Steller's sea cow belonged had once, in mid-Miocene times, shared the coast of California with another sea cow, *Dioplotherium allisoni*. That sea cow differed from *Dusisiren* in having large tusks and a strongly downturned snout deflected some 70° from the palatal plane, resembling that of the living dugong of the Indo-Pacific seas. Evidently it was, like the dugong, a bottom feeder, specializing on sea grasses growing close to the ocean floor. *Dusisiren* (and later, *Hydrodamalis*), in

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contrast, had snout deflections of 45° or less. Steller had made it clear that *Hydrodamalis* had not fed on sea grasses (which are abundant only in the tropics) but on kelps, the large brown and red algae that flourish in cold North Pacific waters. The relatively soft and nonfibrous texture of these algae was believed to explain why *Hydrodamalis* could do without teeth. Marine plants in general have a very incomplete fossil record, but by good luck large kelps were known to have existed in California as far back as the middle Miocene. Therefore I was able to conjecture that while *Dioplotherium* probably ate small, bottom-hugging sea grasses, *Dusisiren* must have exploited the large algae of its time, which grew up toward the surface and did not require a sharply deflected snout for comfortable cropping. However, since *Dusisiren* still retained teeth, it presumably included some of the fibrous sea grasses in its diet. Its descendant *Hydrodamalis* specialized still further on kelp eating and eventually no longer had a need for teeth.

Did this scenario make any sense in the context of North Pacific geological history? Two facts dominated the paleoecological picture: After the middle Miocene, the climate began to cool, a trend that lowered the temperature of coastal waters and culminated in the Pleistocene ice ages; and in the late Miocene and Pliocene, the California Coast Ranges and other mountains were uplifted, draining the previous coastal inlets. The result was to change the Pacific coastline of North America from a series of broad embayments and protected basins to the exposed, rugged shore seen today. This was all that was needed to assemble the remaining pieces of the sirenian puzzle.

Most sea grasses grow best in warm, sheltered waters, in contrast to kelps, which prefer cold, high-energy environments. The cooling and draining of coastal embayments would have eliminated any tropical sea grasses from the northeastern Pacific, accounting for the disappearance of *Dioplotherium* by the end of the Miocene. The very same trends would have been beneficial to the large marine algae, explaining both the survival of *Dusisiren* and the dietary specialization of its descendants.

To feed on kelps, however, the sea cows had to spend more time in cold, turbulent waters off exposed, rocky shores. Increased body size and thicker skin and blubber helped conserve heat; but the blubber and various corollaries of increase in size, such as reduced proportion of body weight represented by the skeleton, led to greater buoyancy. This was not a disadvantage because much of the kelp biomass lay at or near the surface. There were also additional benefits: floating with the back out of the water reduced conductive heat loss, provided exposure to radiant warmth from the sun, permitted entry into shallower water for foraging and for escape from such potential predators as sharks and killer whales, allowed seabirds to remove parasites from the skin (as Steller had witnessed), and possibly reduced wave drag when swimming. Evidently there was no lack of selective pressure for either voluntary or obligatory floating.

On the other hand, the new environment had its dangers. To maintain steering control while feeding among treacherous waves and tides, the sea cows must have had to keep swimming slowly into the current, much like ships riding out a storm. Indeed, Lieutenant Waxell, Captain Bering's second-in-command and a veteran seaman, noticed that *Hydrodamalis* behaved in exactly this way. Increased flexibility of the neck, which skeletal features seemed to suggest and which Steller affirmed, would have been useful for reaching to the sides to crop plants while the body maintained its orientation to the waves and currents. In shoal waters, clawlike forelimbs like those of the Yamagata sea cow must have been ideal for pushing away from rocks, pulling forward against wave surges, and detaching plants. And when all else failed, the barklike hide protected against scrapes.

These and other adaptations to the cooling Pacific allowed the descendants of *Dusisiren jordani* to spread as far north and west as Japan and to flourish until the coming of humans in the Pleistocene. Floating conspicuously in shallow water, the large, tasty mammals had no defense against this new predator. In the absence of any other apparent cause for its extinction, *Hydrodamalis*' survival only in the vicinity of two islands that had never before been reached by humans clearly points to us as the culprits. In view of all the Pleistocene megafauna that shared the same fate, and probably through the same agency, we are lucky that Steller and his shipmates recorded for posterity the few shreds of knowledge about this unbelievable animal that they did. And how fortunate that so many of its ancestors' bones—among which the Great Yamagata Sea Cow is surely the most important—have been preserved.

Daryl P. Domning is a paleontologist and associate professor in the Department of Anatomy at Howard University in Washington, D.C.

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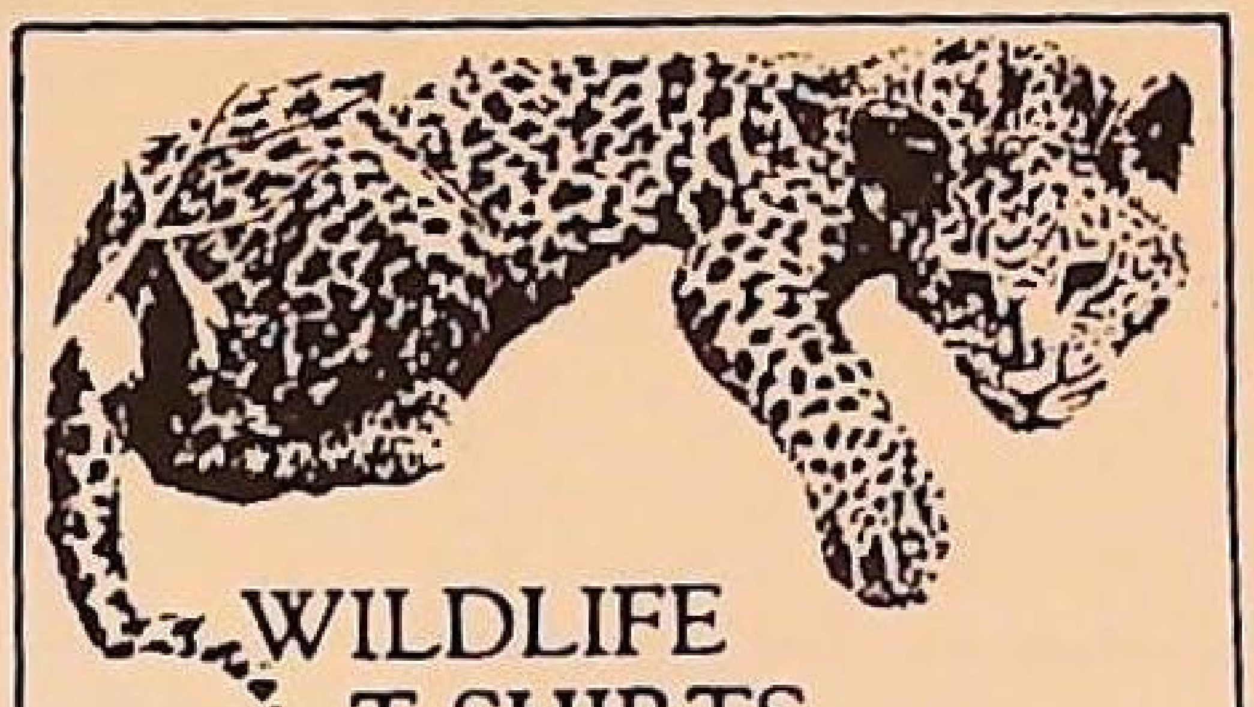

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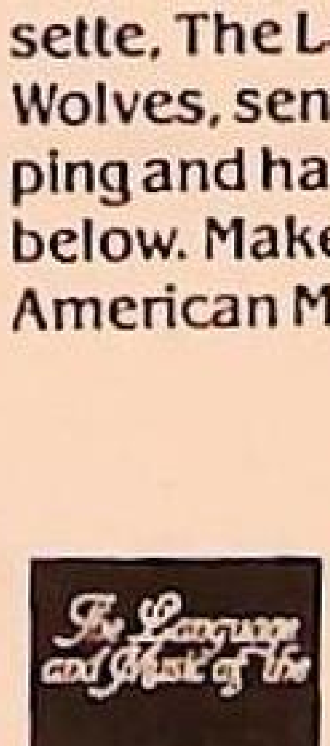

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HOW THE GREAT NORTHERN SEA-COW (RYTINA) BECAME EXTERMINATED.

BY LEONHARD STEJNEGER.

THE conclusions in regard to the extermination of the Great Northern Sea-Cow (*Rytina gigas*) and the causes which led to it, arrived at by the Russian naturalists, Von Baer and Brandt, and by them discussed in numerous publications, were regarded as final, and were generally accepted, until Prof. A. E. Nordenskiöld recently made the startling announcement that, during his five days' stay at Bering Island with the "Vega," he discovered incontrovertible evidence that at least one sea-cow had survived the general slaughter, and had been seen alive as late as 1854, or more than eighty years after the last one was supposed to have been killed. This statement of Professor Nordenskiöld was based upon his interpretation of an account of a strange sea-animal which two Bering islanders claimed to have seen some time previously. Nordenskiöld gave no details to speak of, merely asserting that the description of the animal by the natives tallied so completely with Steller's description of the sea-cow as to leave no doubt that they had really seen a living Rytina; but, notwithstanding this meagreness of the account, the weight of Nordenskiöld's name was then so great that his assertion would probably have been generally accepted. It was my good fortune to spend a year and a half on Bering Island three years after Nordenskiöld's visit, and, as the readers of the "Proceedings of the United States National Museum"[1] will know, I succeeded in bringing to light a number of facts which prove conclusively—as I have published even the minutest details, any one can make up his mind as to the weight of the evidence—that the animal seen by the men was *not* a sea-cow, but that, in all probability, it was a stray female narwhal. To this Nordenskiöld has had no other reply than a reprint of his former assertion, without even an attempt to give any further details or to refute my arguments. The only new point in his answer is an effort to throw discredit on the accuracy of Sauer's "Account of Billing's Expedition in the Years 1785 to 1794," in which Sauer expressly states that the last sea-cow was killed at Bering Island in 1768, twenty-seven years after the island had been discovered by man. In a paper published in the *Bulletin of the American Geographical Society*[1] I have already been able to vindicate Sauer. In the present paper I shall, therefore, only try to demonstrate how easy it is to account for the rapid extermination of this huge animal, if we take all the known facts into consideration. To any one familiar with the literature on the subject such an undertaking might be supposed to be superfluous, so well has the task been performed long ago by the great Russian scientists already referred to; but I may perhaps be able to elucidate the subject a little further,—a labor apparently not quite unnecessary, in view of the following remarkable statement of Professor Nordenskiöld (*Bull. Amer. Geogr. Soc.*, 1885, p. 281): "It cannot very well be supposed that in a sea so rarely visited in the last century as the northern part of the Pacific Ocean the last specimen of the genus Rytina should have been slain by the harpoon of the hunter. I even imagine that the hardly accessible coasts of Bering and Copper Islands have been very rarely visited by hunters since Steller's day, 1741." As will be seen from the following pages, there was no need of "imagining" anything of the kind, when the facts, as related in the literature, so amply prove the contrary.

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[1] Vol. vii., 1884, pp. 181–189.

As everybody knows, Bering and his unfortunate comrades, among them the immortal Steller, in the autumn of 1741, discovered the then uninhabited island which afterwards received its name from Bering, who died there shortly after. The survivors of the expedition wintered on that island, and when they landed there they saw the first living sea-cows (Rytina) ever beheld by white men.

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[1] 1886, No. 4, pp. 317–328.

Unfortunately, Steller, in describing this animal and its habits, only says that he found it numerous and in herds, without stating exactly how numerous or in how large herds. We are thus left to guess at their probable number when first found; and from what he says in regard to their habits and the places they frequented, and from what I know of the natural conditions of the island, I should regard fifteen hundred as rather above than below the probable number. It must be remembered that the sea-cow was an extremely bulky animal, twenty-four to thirty feet long, which lived chiefly near the mouths of the rivulets, feeding on the sea-weeds, especially the large Lamellarias. There are hardly more than fifteen places on the island which could afford them suitable grazing-grounds, and if each of these were regularly visited by an average of one hundred animals, one would easily be impressed by their number, especially if divided up into five to ten herds of from ten to twenty individuals.

There can hardly be any doubt that these animals were the last survivors of a once more numerous and more widely distributed species, which had been spared to that late date because man had not yet reached their last resort. It is, then, pretty safe to assume that this colony was not on the increase, and that, under the most favorable circumstances, the number of surviving young ones barely balanced the number of deaths caused by the dangers of the long winters. Under this supposition, every animal killed by a new agency—in this case by man—represents one less in the total number.

No sooner did the survivors of Bering's expedition return to Kamtschatka, in 1742, than hunting expeditions were fitted out; for already, in 1743–1744, we find Bassoff and his crew wintering on Bering Island, and from that year and until 1763 hardly a winter passed without one or more parties spending eight or nine months in hunting fur-animals there, during which time the crews lived almost exclusively on the meat of the sea-cow. But that is not all, for more than half of the expeditions which wintered there did so for the express purpose of laying in stores of sea-cow meat for their farther journey, which usually lasted two to three years more.

In order to substantiate the above assertion, I shall give a detailed list of the expeditions which are *known* to have wintered on Bering Island during the twenty years in question. The old records are very defective, and it is extremely probable that many more of the expeditions which left Kamtschatka in order to hunt and trade on the Aleutian Islands and in America stopped at Bering Island, as was the usual custom; but we shall only enumerate those of which the records expressly say that they wintered there. The number of men employed on the vessels is not given in all instances, but, as it varies between thirty and fifty, I have estimated it to be thirty in most cases of which we have no definite record. In the few instances in which the length of time spent on the island is not given I have estimated it to be eight months, which is shorter than the shortest time actually recorded:

Winter.	Name of Owner or Captain of Vessel.	Men.	Months.	Remarks.
1743–1744..	Basoff.........	(30)	(8)	Numbers in parentheses estimated.
1745–1746..	Basoff.........	(30)	12	Months, only approximate figures.
1747–1748..	Kholodiloff...	50	9	
1748–1749..	Bakhoff.......	(30)	11	
1749–1750..	Tolstykh......	50	8½	
1751–1752.. 1752–1753..	Yugoff........	26	(16)	There is some uncertainty about the time Yugoff spent on Bering Island. He is said to have wintered from 1751 to 1754 on Bering and Copper Islands,—about thirty-two months. It is not probable that he spent less than half of this time on Bering Island.
1753–1754..	Kholodiloff...	34	10	
1754–1755..	Drushinin....	(30)	(8)	
1754–1755..	Durneff.......	(40)	(8)	
1754–1755..	Krassilnikoff.	(30)	9½	
1754–1755..	Jakovleff......	33	(6)	
1755–1756..	....	4	....	These four men belonging to Drushinin's crew were left behind.
1756–1757..	Krassilnikoff.	(34)	(8)	Krassilnikoff's crew and four of Drushinin's.
1756–1757..	Tolstykh......	38	9	
1757–1758..	Shilkin........	39	(8)	
1758–1759..	Paikoff........	45	9½	
1760–1761..	Tolstykh......	(38)	8½	
1762–1763..	Korovin	45	9½	
1762–1763..	Medvedeff....	45	(9)	

It will be seen that there wintered in 1754 to 1755 about one hundred and thirty-three men, and in 1762 to 1763, ninety men.

In addition to the above, we know of a number of expeditions wintering on Copper Island, and many more which passed by the Commander Islands on their way east. Besides, how many were there of which we know nothing? And yet Professor Nordenskiöld imagines that these islands "have been very rarely visited by hunters since Steller's day,—1741"!

Some of the records in regard to the above expeditions are very interesting as having a direct bearing on the question before us. Thus, it is said, *à propos* of Krassilnikoff's wintering on Bering Island, that "it had already become customary for all vessels intending to hunt sea-otters on the more distant islands to winter there [Bering Island] in order to provide sufficient stores of the meat of the sea-cows (*Manati*)." These expeditions lasted usually three to four years, and it is safe to assume that they laid in provision for not less than twelve months. Of the expeditions enumerated in the above list, ten, with an aggregate of about four hundred men, belong to this category.

Still more valuable are the details which have been recorded in regard to Jakovleff's expedition. He was a mining engineer, consequently a man of education and intelligence, as his reports also testify, sent out by the Russian government in order to investigate the alleged occurrence of native copper on Copper Island. The records show, beyond dispute, that when this island was first visited (1745 to 1746) sea-cows occurred along its beaches (and I myself have found remains of them on that island); but in 1754, when Jakovleff was to explore Copper Island, he was obliged to winter on Bering Island, *because at that early date, nine years after the first visit, the sea-cows had been extirpated on Copper Island by man!*

Including his crew, there wintered that year, on Bering Island, hardly less than one hundred and thirty-three men, one of the chief occupations of whom it was to procure, during eight months, as much sea-cow meat for their future expeditions as they possibly could. This was done regularly by harpooning the animal from a boat manned with eight oarsmen, and when killed it was immediately towed to the shore to be hauled up on the beach and cut up at once, as the meat would spoil if left unattended until the next day. This was the method for securing provisions for the vessels, but a much more wasteful manner was pursued in killing the animals which served as food for the hunters during their sojourn on the island. From Jakovleff's diary we learn that the hunters were scattered all over the northern (*i.e.*, northern and eastern) shore of the island by twos and threes for the sake of catching foxes and other fur-animals, while sea-cow meat was the only food available.[1] These men, in order to obtain food, had to secure their sea-cow single-handed, and whenever they got an opportunity—what they often did—they would sneak up to an animal lying close to the shore or in shallow water, and wound it mortally by thrusting the iron-shod pole into it. The animal, which was hardly ever killed outright, sought the high sea and died there. If it drifted ashore the same day, well and good; but in most cases it came in unfit to be eaten, if it was not carried away altogether. So impressed was Jakovleff with the extreme wastefulness of this method that he predicted the speedy extermination of the sea-cow unless some precautions be taken against this senseless slaughter; and when, in 1755, he returned to Kamtschatka, he presented a petition to the authorities there that it be prohibited by an ukas to kill sea-cows in this manner, "in order that Bering Island may not be devastated in the same manner as Copper Island." Of course, nobody heeded this eminently wise suggestion, and the result became as he had predicted it: the last sea-cow was killed within thirteen years.

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[1] It is even probable that Jakovleff refers to a more or less regular population of hunters, in addition to the crews of the wintering vessels.

Can anybody who contemplates the fact that the sea-cow was an exceedingly stationary animal, which was bound to the kelp-fields near shore; that it was extremely stupid and sluggish; that it was deprived of the faculty of diving; and that the island offers absolutely no shelter or concealment for it,—can anybody, after having read Jakovleff's report and petition, possibly entertain a doubt that the last specimen of the genus Rytina was slain by the harpoon of the hunter?

But let us attempt a calculation, based upon the former guess as to the original number of living sea-cows when Bering Island was first visited, and upon the facts as they have been presented above. Before doing so we will have to estimate the number of animals wastefully slaughtered, and from the statements made by Jakovleff I should think it no exaggeration to say that there were killed five times as many animals as were actually utilized. From Jakovleff's report we learn that one sea-cow would furnish food sufficient for thirty-three men during a whole month, and, although it is probable that he made his party utilize each animal in a higher degree than the other hunters, we shall take the above figures as indicating the average. It will be seen that we do not take into account Burdukovski's statement, that only the kidneys were eaten, for he only had his knowledge from hearsay, while from Jakovleff's diary it seems evident that all the meat was eaten. This is an additional reason why no weight should be attached to the rest of Burdukovski's story.

Now, to supply the six hundred and seventy men which we know wintered on Bering Island between 1743 and 1763, during an average time of ten months, it required, in round figures, about two hundred and five animals. According to the same method of calculation, we find that the four hundred men who laid in provisions for protracted journeys would require about two hundred and ninety animals for an average time of twenty-four months,—together, four hundred and ninety-five animals. If five times as many cows were wantonly killed as were utilized, we have a grand total of two thousand four hundred and seventy-five sea-cows slaughtered up to the year 1763, or nearly one thousand in excess of our estimate of the original number. We can therefore either admit that there were more than two thousand living sea-cows when Steller discovered them, or else that only twice as many animals were wasted as were properly utilized; but, whatever conclusion we choose, it is manifest that our estimates have been very reasonable.

From 1763 the visits to Bering Island seem to grow scarcer; at least, the records contain nothing definite that I am aware. This is probably due to the very fact that sea-cows had now become so nearly exterminated that the few left were insufficient to maintain any wintering and foraging expedition, while, at the same time, the fur-bearing animals were also so badly decimated that it would not pay for a large party to hunt them. The smaller animals, as we know, would recuperate when left undisturbed for a few years, and it was probably by a party who went out to Bering Island in 1767 or 1768—possibly on one of Popoff's vessels—in order to catch blue foxes that the last sea-cow was mercilessly killed. Four years after, in 1772, Dmitri Bragin again wintered on Bering Island, and, from the fact that in the list he gave of the animals of the island he omitted the sea-cow, it is reasonably safe to conclude that not one was left to be recorded by him.

After all, there is nothing surprising in the speedy extermination of this clumsy animal, which could not dive, and which had actually no means of defence or escape. It is too well known that it did not emigrate, and the theory that it was driven off to other places is not only directly disproved, but is quite unnecessary in order to explain the sudden disappearance of the Great Northern Sea-Cow from the shores where it was first discovered.

I think it will be admitted that we have succeeded in materially strengthening Sauer's assertion, that the Rytina was exterminated in 1768, and that the above is a fair exposé of the causes which led to its final extirpation. It was simply due to man's greed, and he accomplished it within the short time of twenty-seven years.

THE MATERIALS OF THE APPALACHIANS.

BY E. W. CLAYPOLE.

(Concluded from page 962.)

THE FOUR GREAT SANDSTONES OF PENNSYLVANIA.

IN the former part of this paper I dwelt on the fact of the existence of several thick sandstones and quartz conglomerates in the massive palæozoic deposits of Pennsylvania. I further showed that these rocks indicate a supply of quartz far greater than could be furnished from any existing source; and, thirdly, that the nature of this quartz is such that the only known origin for it is the quartz-ledges of the South Mountains. Hence I inferred the former extension of these strata over a greater extent of country than at present.

In this second part I propose to try and give a more definite shape to this conclusion, and to at least suggest where and when this palæozoic land existed.

Excluding, for various reasons which it is not necessary here to mention, the Potsdam Sandstone, there remain four great sheets of sandstone, more or less conglomeratic, in the immensely thick palæozoic deposits of the Eastern States. Between them there lie massive, softer deposits of shale and limestone. In descending order these beds are as follows, omitting all minor and insignificant layers:

		Feet.
	Shale, coal, sandstone	Variable.
4	Sandstone and pebbles (Pottsville Conglomerate)	1500
	Shale (Mauch Chunk)	1500
3	Sandstone and pebbles (Pocono Conglomerate)	2000
	Sandstone and pebbles (Catskill Sandstone)	6000

Nov. 26, 1934
NEW YORK TIMES
17: 6

CANADIAN MONSTER SIMILAR TO SEA COW

Henry Island Serpent May Be Mammal Believed Extinct 150 Years, It Is Said.

VICTORIA, B. C., Nov. 25 (CP).—A theory that the strange serpent-like marine monster of Henry Island might be a survivor of the species of northern sea cows, Rhytina Stelleri, believed extinct more than 150 years, was advanced today by British Columbia museum authorities.

In The Royal Natural History, published by Richard Lyddecker in 1894, they found records of a supposedly now extinct animal by a naturalist named Steller, who accompanied the great navigator Behring, in his explorations off the Alaskan Coast.

Lyddecker's description of the mammal showed it was similar to the strange 35-foot monster found lying on the shores of Henry Island, south of Prince Rupert, they reported. In at least six ways, including its long serpentlike shape, its bristles and skin, it corresponded to the Henry Island creature.

At Prince Rupert, Dr. Neal Carter, director of the Dominion Experimental Station at Prince Rupert, continued his work on preserving and dissecting it.

He said he would be glad to obtain the opinion of Professor Trevor Kincaid, noted marine expert of the University of Washington, if Professor Kincaid wished to make the trip north.

"However, until our own biological expert, Dr. W. A. Clemens of Napaimo, has had a chance, I do not feel inclined to invite any one else," he added.

Dr. Francis Kermode, museum director here, examined a half a dozen hooked quills and several portions of the hide, which had been taken from the creature's carcass and forwarded here, and said he had never seen anything like it before.

"It certainly was not a whale," he said.

18, 1974
Thursday April
Bridgeport Conn
Bridgeport Post

OCAL EXHIBITS BONES OF EXTINCT SEA BEAST

BERKELEY, Calif. (AP) — Scientists at the University of California at Berkeley recently unveiled the rare skeleton of a giant sea mammal that once paddled about the shallow coastal waters off California and the rim of the North Pacific millions of years ago.

The creature, known scientifically as paleoparadoxia (ancient paradox) has characteristics of both sea cows and mastodons. It may have been a common ancestor to both species, according to Dr. Joseph Gregory, director of the UC Berkeley Museum of Paleontology, before becoming extinct approximately 10 to 12 million years ago.

In its prime, paleoparadoxia was more than 9 feet long from nose to tail, weighed about a ton, had short, powerful legs and probably uprooted soft plants or mollusks with its tusklike front teeth, grinding its food with small, low-crowned molars.

The skeleton was first uncovered almost 10 years ago when workmen began excavating the Aplo Alto site now occupied by Stanford university's linear accelerator. It was almost intact, missing only e skull and some of the neck rtebrae.

Saga of Steller's Sea Cow

by Delphine Haley

Natural History
Vol. LXXXVII No 9
November 1978

The largest sea mammal of its kind was last reliably seen in 1768. Some sketchy Soviet sightings suggest it survives

The Steller's sea cow is the only North Pacific sea mammal to become extinct in historical times. Discovered in the winter of 1741–42, when explorer Vitus Bering's crew was shipwrecked on an island that would later bear their leader's name, this giant marine herbivore was literally devoured into oblivion because of its beeflike meat and sweet-tasting blubber. For twenty-seven years following its discovery, the sea cow was a major food source for Russian hunters seeking sea otter fur across the North Pacific. It lived only in the shallow waters off Bering and Copper Islands, in the Commander Islands some 100 miles east of Siberia in the Bering Sea. Slow-moving and unsuspicious, it grazed on seaweeds until its disappearance about 1768.

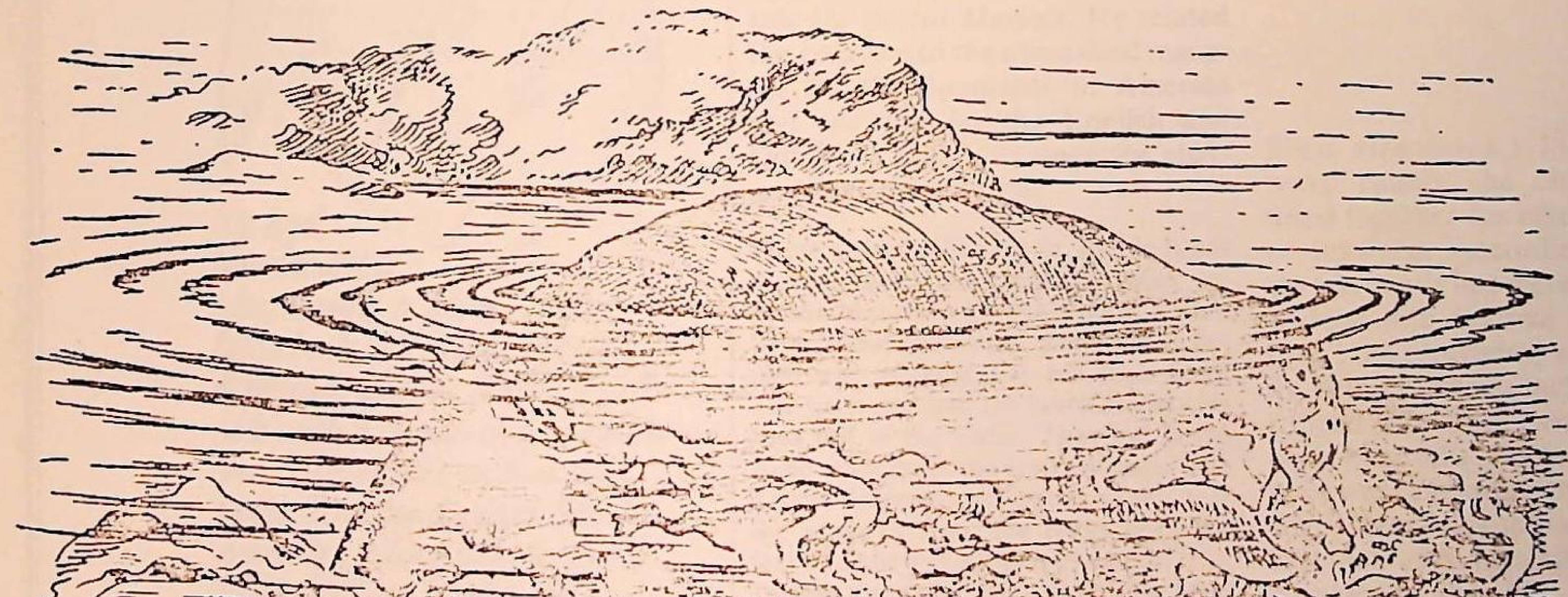
Georg Wilhelm Steller, the Bering expedition's naturalist and surgeon, was among the first to notice the sea cow. It resembled an overturned boat until it moved, when it revealed a huge, spindle-shaped body as much as twenty-five feet long, ending fore and aft with a disproportionately small, bristly muzzled head and a large, laterally lobed tail. We are indebted to Steller for the only scientific description of the sea cow—one of many species that bear his name.

The Steller's sea cow, along with the dugong and manatee, is a member of the order Sirenia. Although superficially resembling the modern whales and seals, the sirenians are actually descended from a pig-sized primitive ungulate, *Moeritherium*, which led a hippolike existence in the Upper Eocene some fifty million years ago. Oddly enough, its modern descendants, aside from the aquatically adapted sirenians, are the hyrax and the elephant.

Sirenians share a fusiform shape, a heavy-boned frame for stability, a horizontally flattened tail, a tough, wrinkled hide, bristly hairs around the lips, and a preference for coastal waters and estuaries where aquatic vegetation is abundant. They lack both an external ear and a dorsal fin. Two families—the manatee (Trichechidae) of the tropical Atlantic and Caribbean and the dugong (Dugongidae) of the Indian Ocean and East African and Indo-Malaysian waters—are the order's present representatives.

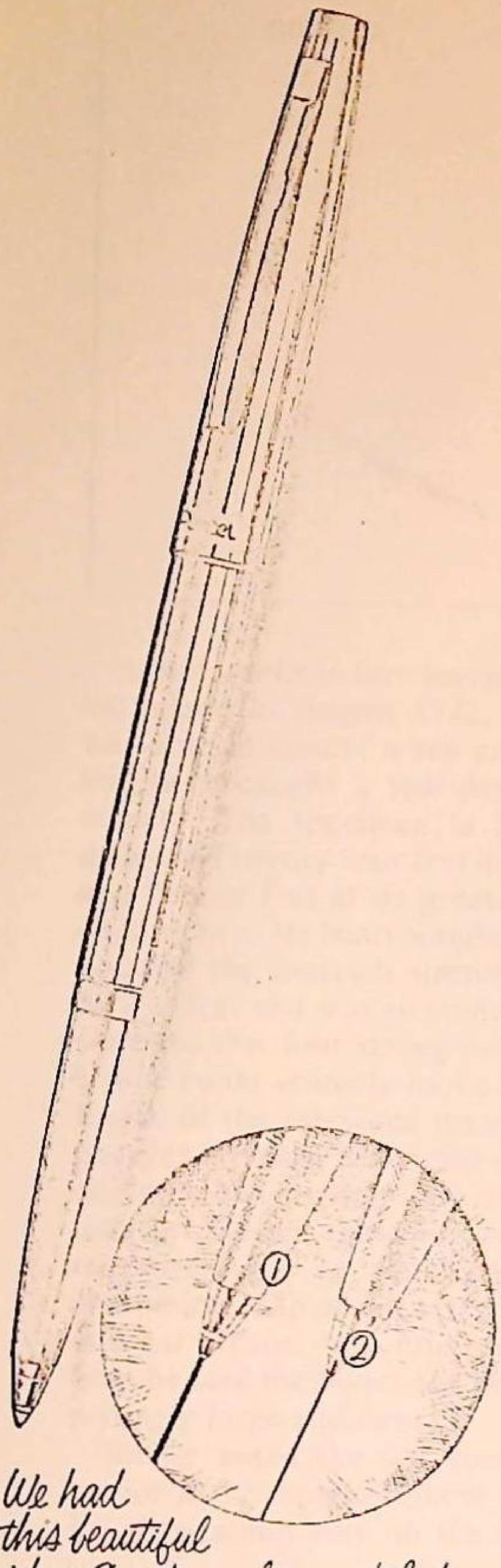
The sea cow, a dugongid, was the only recent family member to adapt

Adapted from *Marine Mammals of Eastern North Pacific and Arctic Waters*, ed. by Delphine Haley. Pacific Search Press; Seattle, Washington; 1978.



From the Soviet scientific journal *Priroda*, 1965

Illustration of a reputed Steller's sea cow



We had this beautiful idea: Create a slim-styled liquid ink ball pen in a variety of elegant finishes that's ① refillable with a choice of four colors and ② available in fine and extra-fine point sizes. It's the smooth writing easy-to-hold Slim Rolling Writer pen.

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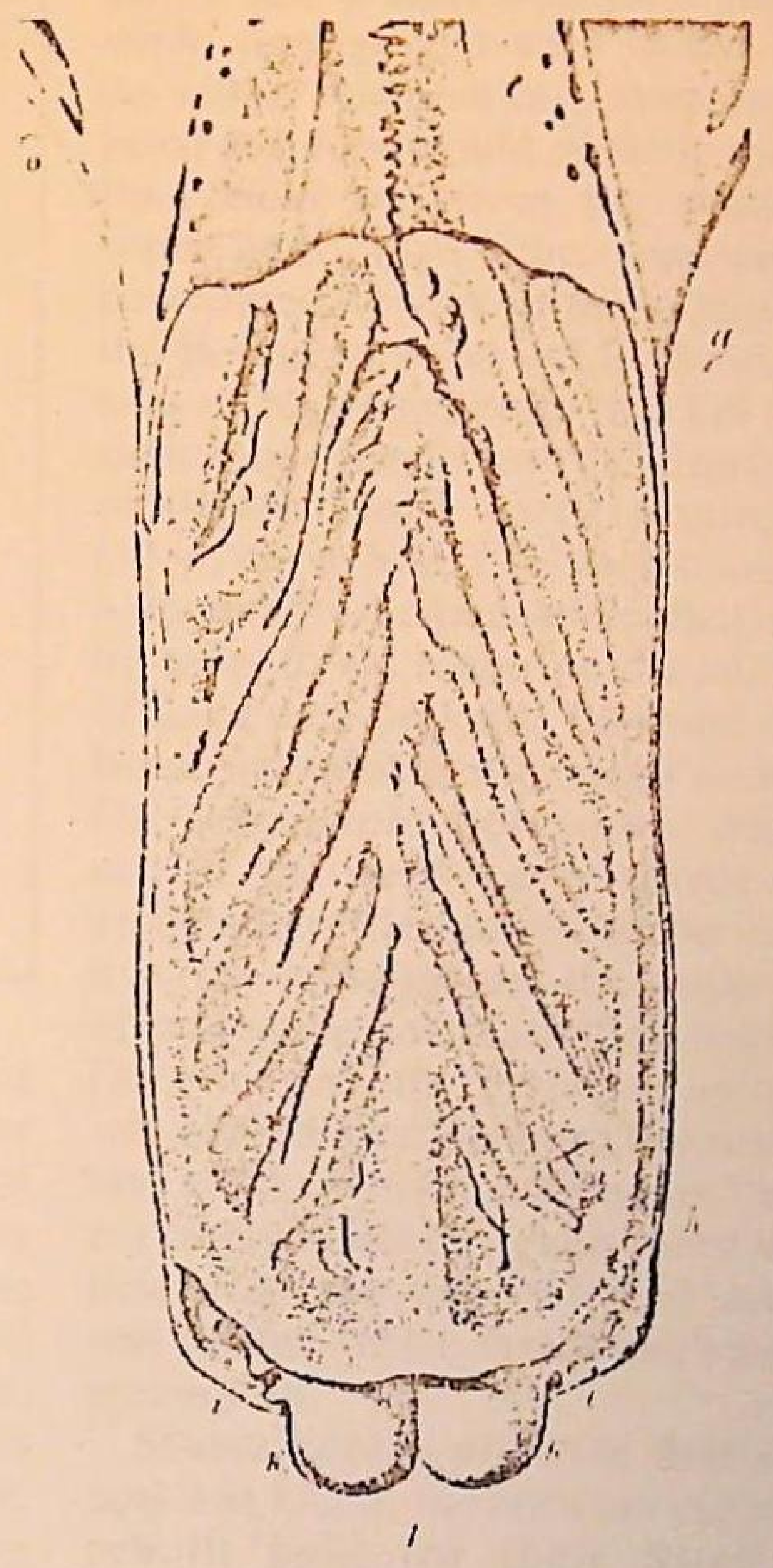
to the cold waters of the north. To accomplish this, it evolved distinguishing traits, which Steller described. The sea cow was by far the largest sirenian, up to twenty-five feet in length. Its weight is confusing, for Steller records it at "200 pud," or 4.5 tons, and "1,200 pud," or 26.8 tons. (Marine mammalogist Victor Scheffer, using a clay model of the sea cow, has calculated its weight at 7 tons for a sea cow some twenty-five feet long.) Four inches of fat—nine in some places—provided insulation from the cold, and an inch-thick hide furnished protection from the abrasions of ice and surf-pounded rocky coasts. Its hairless, black, elephantlike hide—sometimes marked with white spots and zones—displayed a very rough cuticle, particularly around the head, eyes, ears, breasts, and under the forelimbs. The hide was uneven, full of grooves, wrinkles, and funnel-shaped lesions, or pits, gnawed out by a parasitic amphipod later named *Cyamus rhytina*. Seagulls were known to sit on the sea cows' backs and feed on these parasites.

Steller's descriptions of the sea cow and other North Pacific sea mammals were published posthumously in 1751 by the Saint Petersburg Academy of Science under the title *De Bestiis Marinis*. He related the creature to the one called manatee by the Spaniards in America and sea cow by the English and Dutch. In noting its ungulate characteristics, he wrote,

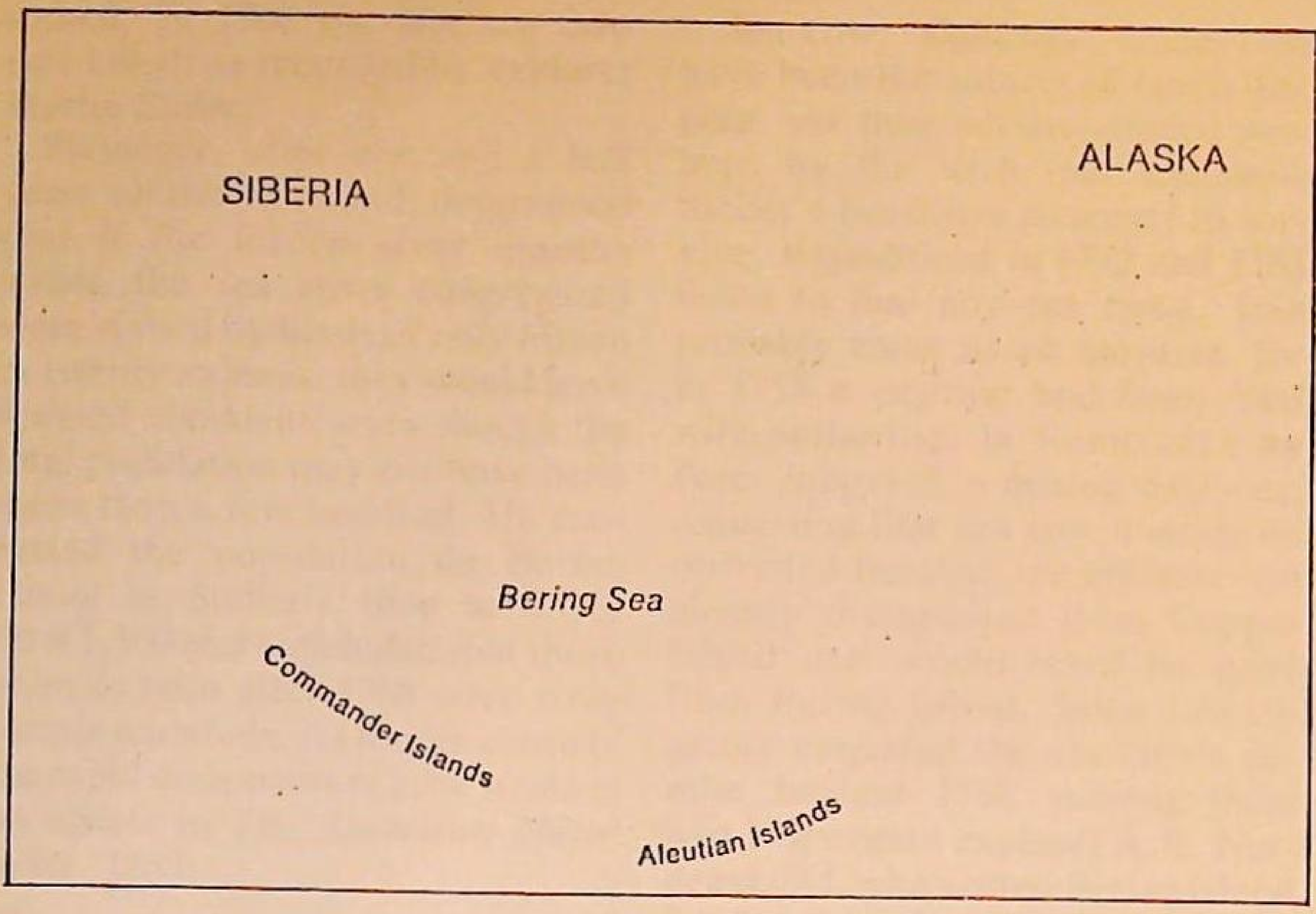
> These animals, like cattle, live in herds at sea, males and females going together and driving the young before them about the shore. They are occupied with nothing else but their food. The back and half the body are always seen out of the water. They eat in the same manner as the land animals, with a slow forward movement. They tear the seaweed from the rocks with the feet and chew it without cessation. . . . During the eating they move the head and neck like an ox, and after the lapse of a few minutes they lift the head out of the water and draw fresh air with a rasping and snorting sound after the manner of horses.

The sea cow had several unusual physical features. Instead of teeth, two flat plates—one attached to the upper jaw, another to the lower—served as chewing organs. (Subsequent examination of the plates identified them as horny, tubercle-filled structures.) Indented with wavy canals, the chewing plates fitted together for efficient mashing of seaweed. According to Steller, the sea cow's lips were "double and divided into internal and external lips," the protruding exterior upper lip being fourteen inches wide and fringed with thick bristles. In spite of its huge size, the animal's lidless eyes were no larger than those of a sheep. Nor was there any trace of an external ear; instead, within the wrinkles of the skin, there was an opening "hardly large enough for the insertion of a pea." The two-foot-long forelimbs were used for moving about in the shallows or for supporting the enormous body on slippery rocks. Most peculiar to Steller were the clawless forefeet, which he said resembled horses' hoofs, except that they were "furnished underneath with many short and closely set bristles like a scratch brush."



Rendering by J.F. Brandt of the chewing plates that took the place of teeth in the Steller's sea cow

From *Symbolae Sirenologicae*, 1849



A few weeks before leaving Bering Island in August 1742, Steller was able to dissect a sea cow that had been caught a few days previously. The specimen, a female, measured twenty-four feet in length and twenty feet at its greatest circumference. Its heart weighed 36½ pounds; the stomach stretched six by five feet and was so stuffed with seaweed that four strong men with a rope could scarcely move it. The length of the intestinal tract, from pharynx to anus, was 5,968 inches, or almost twenty times the animal's length. Steller took forty-seven measurements as he charted an anatomical map of the external and internal organs. In a brief description, he said the bones seemed surprisingly large and dense.

Steller noted the sea cows' behavior as he watched them during his nine-month stay on the island. He described their preference for shallow and sandy places along the shore, particularly at the mouths of freshwater streams where they sometimes came in so close that he stroked their backs. They pastured in family groups—a male, a female, and a "little tender one"; the adults always keeping the calf in front or, when traveling in a group, guarding it in the midst of the herd. Steller believed they were monogamous, with mating usually in early spring and most of the single newborns appearing in autumn after a presumed gestation of more than a year.

The sea cow's docile disposition and slow-moving habits, its (presumed) low reproduction rate and limited distribution were its undoing. In addition, its single-minded appetite for certain seaweeds made it heedless of all danger. One could safely row a boat into their midst while they grazed with heads underwater. Furthermore, even an injured sea cow would do little more than move out from the shallow water and return later, apparently bewildered. Aware of these habits, the Bering crew set out in the calm seas of May to capture and kill the delicious food source floating offshore. Their early attempts failed, but in June 1742 they hooked a sea cow from a boat and pulled it in by rope, a feat requiring the efforts of forty men on land. En route the beast struggled and moaned softly. On subsequent occasions, when one of the herd was hooked, its companions tried to rescue the captive by pressing on the rope or upsetting the boat with their backs. Once landed, the immense animal was carved into sections. The resultant steaks were described as "exceedingly savory"; even more delicious to the malnourished crew was the fat, which tasted like sweet almond oil.

Several weeks after the first sea cow was killed, the crew set out in a rebuilt boat for their Russian homeland. They took with them a supply of sea cow fat and salted meat, and news of a fortune to be made in sea otter, fox, and seal furs—with a food source in the sea cow. For the next twenty-seven years, successive fur-seeking expeditions slaughtered the sea cow. According to Steller's biographer, Leonhard Stejneger, the animal was rarely killed outright; instead, the wounded sea cow usually died slowly of its wounds. Only one out of five killed was actually con-

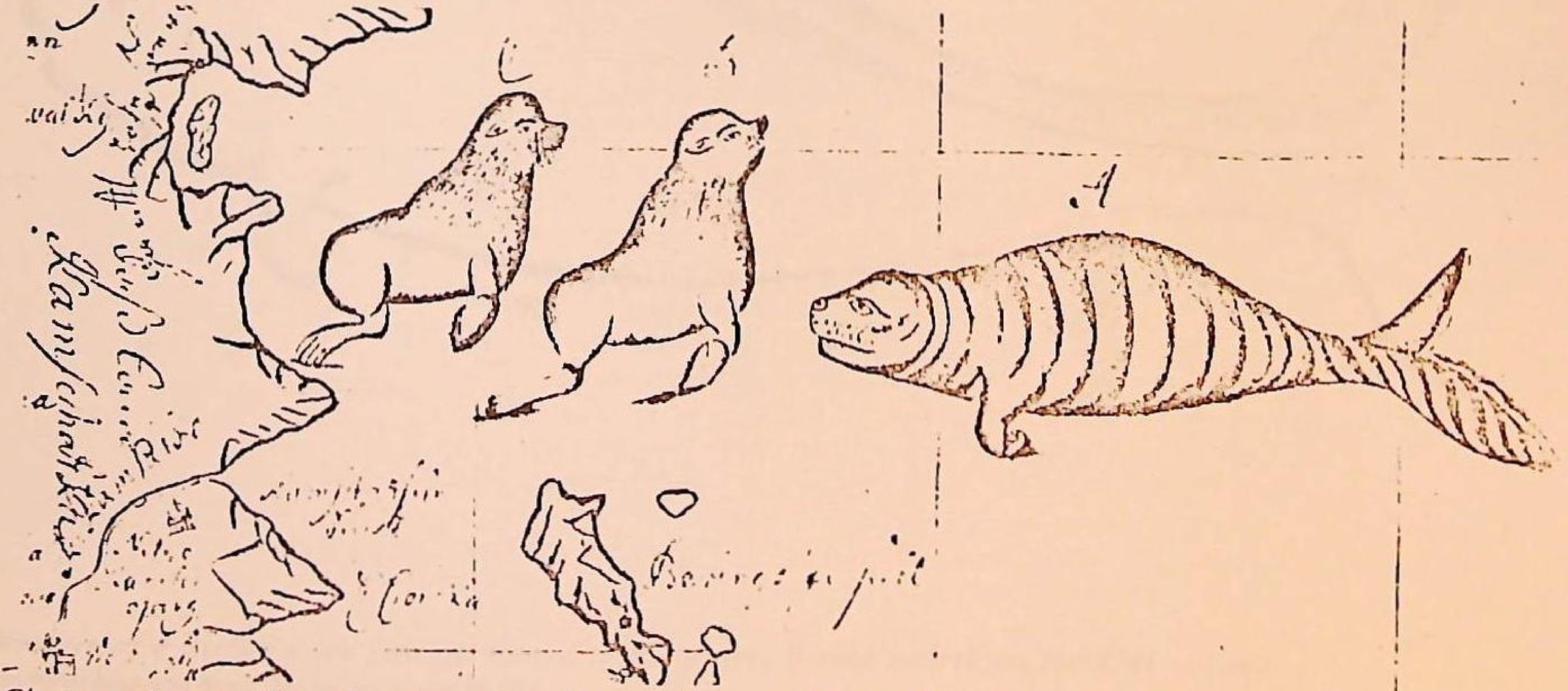


Chart section (attributed to Swen Waxell, an officer on Bering's 1741 expedition) depicting sea mammals of the Bering Sea: (a) sea cow, (b) sea lion, (c) fur seal sumed. In 1768 the last sea cow was killed, as recorded by explorer Martin Sauer.

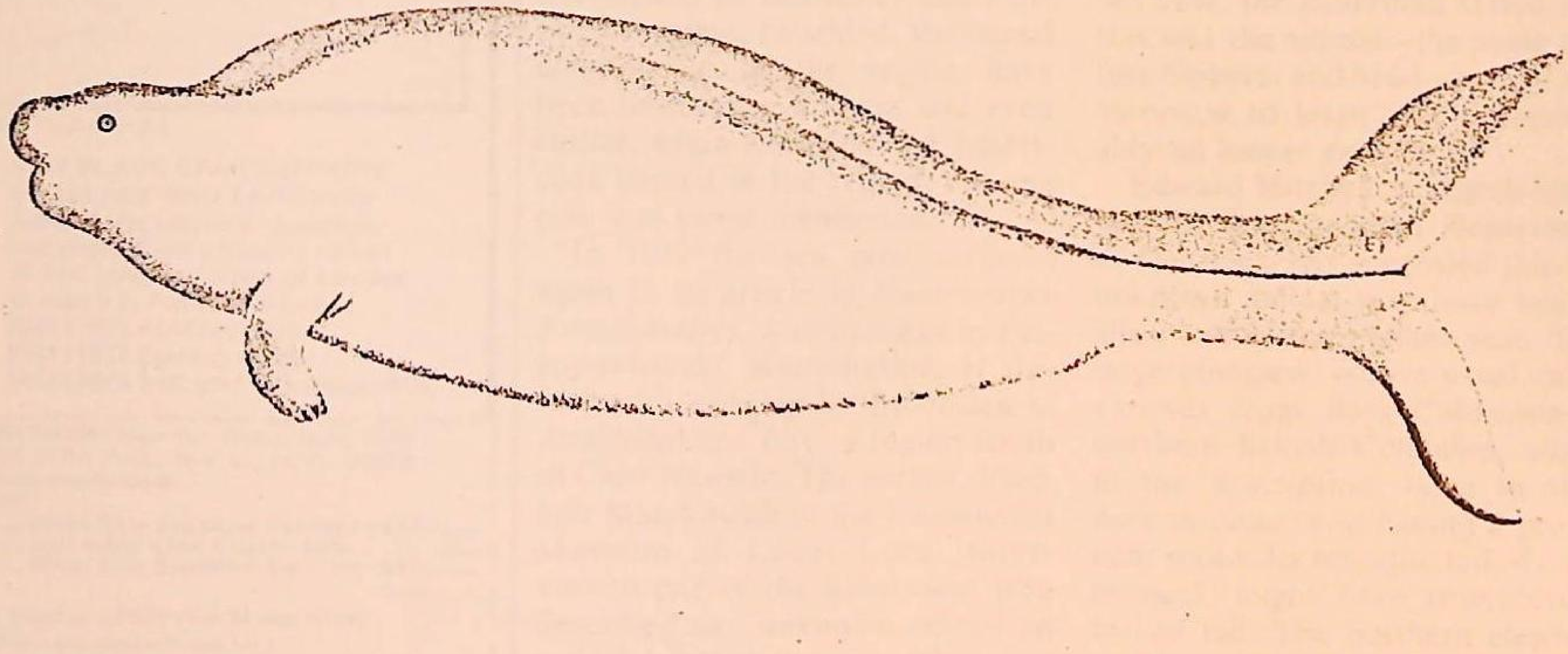
Stejneger, after one and a half years on Bering Island, determined that if the fifteen river mouths where the sea cows congregated were visited by herds of only fifteen or twenty animals, they would have seemed abundant, even though the total population may not have been more than a few hundred. He estimated the population on Bering Island in Steller's time at fewer than 1,500 and concluded that those animals seen after 1768 were stray female narwhals. As for the cause of the rapid disappearance, he wrote in an article in *The American Naturalist*, 1887:

> There can hardly be any doubt that these animals were the last survivors of a once more numerous and more widely distributed species, which had been spared to that late date because man had not yet reached their last resort. It is, then, pretty safe to assume that this colony was not on the increase, and that, under the most favorable circumstances, the number of surviving young ones barely balanced the number of deaths caused by the dangers of the long winters. Under this supposition, every animal killed by a new agency—in this case by man—represents one less in the total number.

Sea cow "sightings" since 1768 have been the subject of much dispute, yet they persist—fueled perhaps by the wish that somehow Steller's beast has managed to survive. Expeditions in 1772 and 1783 failed to find any sea cows. This probably came as no surprise, for in 1755 a petition had been filed with authorities in Kamchatka by Peter Jakovleff, a mining engineer, requesting that sea cow hunting be restricted because the animals had already disappeared from Copper Island and would soon be gone from Bering Island. Some investigators extended the sea cow's demise beyond 1768. Among them was Norwegian explorer A.E. Nordenskiöld, who visited Bering Island for five days in 1879. While there, he spoke with three natives who stated that they had seen animals of this description as late as 1854.

Even in recent years, there have been reports of sea cows in the North Pacific. In July 1962, a Soviet research vessel near Cape Navarin, northeast of the Kamchatka Peninsula, came within 300 feet of six very large, unusual-looking dark-skinned animals feeding offshore. They had relatively small heads and bifurcated upper lips, which, perhaps because of their thick whiskers, seemed to project beyond their lower lips. The animals, twenty to twenty-seven feet long, maintained a tight formation, swam slowly, dived at regular intervals for short periods, and emerged high out of the water. A similar animal was seen in the same area on the following day. In an article in the Soviet scientific journal *Priroda*, the authors (A.A. Berzin, E.A. Tikhomirov, and V.I. Troinin) state that this sighting was only the most recent of several that had been reported in the region. To show that such reports were not impossible, they added that since the 1950s two completely new marine mammal species had been discovered—the ginkgo-toothed whale and the Gulf of California porpoise.

As anticipated by the authors, the sea cow sighting was challenged, also in *Priroda* (1965), by Soviet zoologist V.G. Heptner, who labeled it another in a trend of reporting Loch Ness-like creatures. He noted a gap of 194 years between the last trustworthy sea cow sighting (1768) and the Cape Navarin report (1962), and asked, could such a visible animal, one whose back was usually exposed and on which seagulls often



Drawing of a Steller's sea cow attributed to Plenisner, Bering's clerk on the 1741 voyage

From Pallas' *Zoographia Rosso—Asiatica*, vol 1, plate 30, 1826

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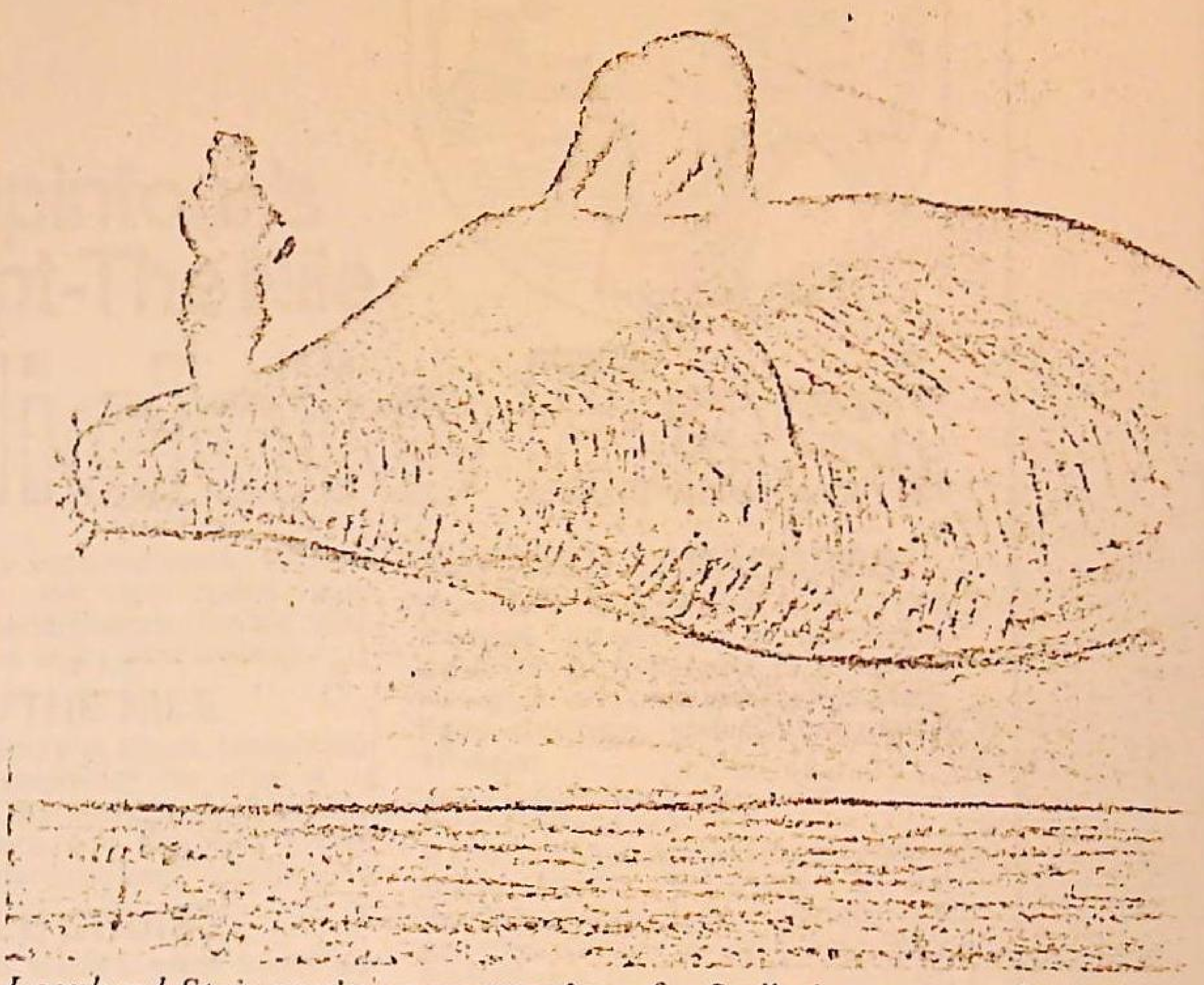
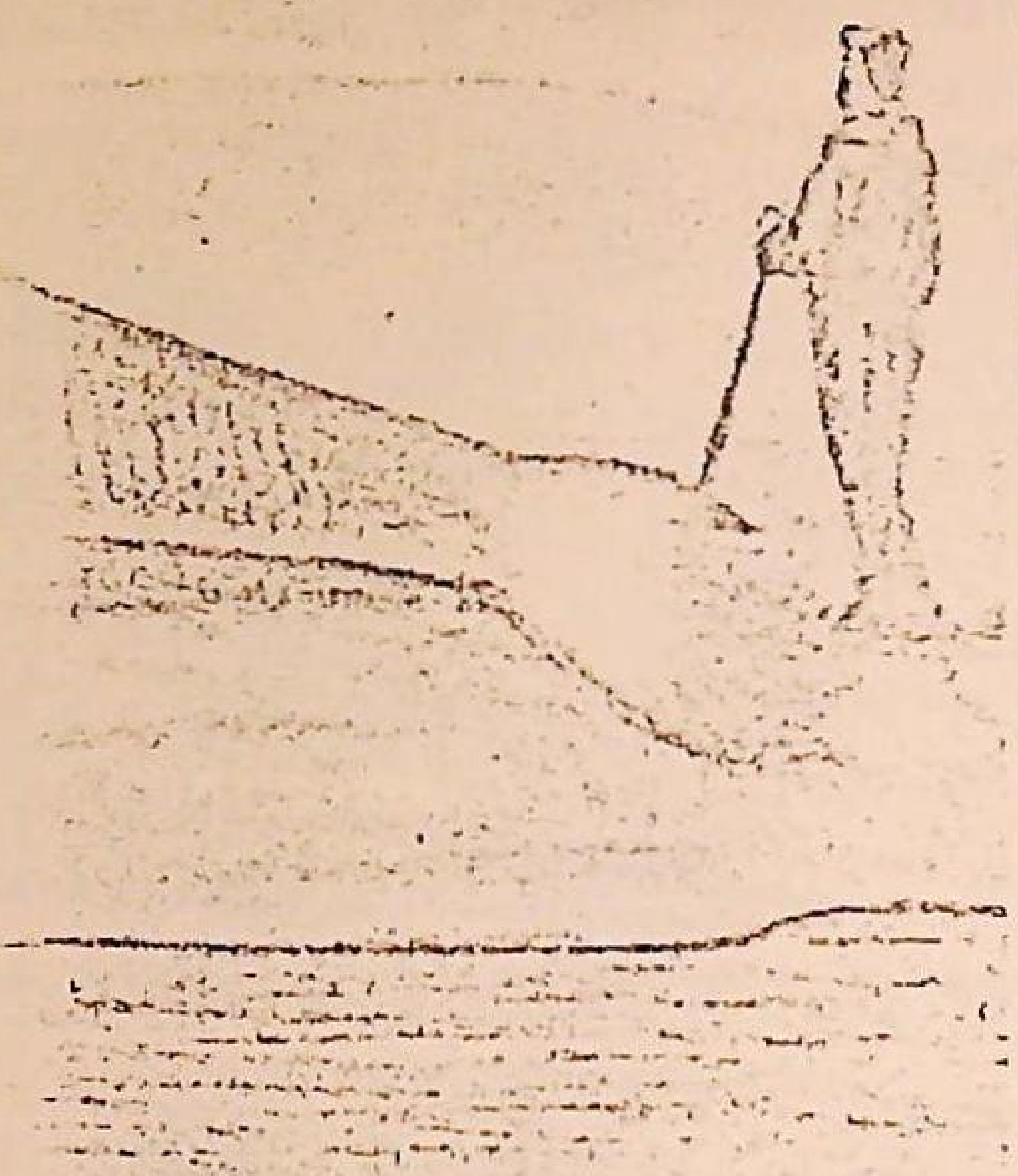


Leonhard Stejneger's reconstruction of a Steller's sea cow shows it being measured for the first time

perched, an animal that grazed near shore and left behind heaps of seaweed piled on the beach, have been overlooked all this time? Since the Soviet regime, he added, the faunal components of the region have been thoroughly known; and even earlier, when Russians and Americans hunted in the region, the sea cow was never mentioned.

In 1977 the sea cow surfaced again in an article in *Kamchatsky Komsomolets*, a newspaper in Petropavlovsk, Kamchatka. It described a sighting by fishermen in Anapkinskaya Bay, a region south of Cape Navarin. The author, Vladimir Malukovich of the Kamchatka Museum of Local Lore, interviewed one of the fishermen, who described an "unknown animal on a tidal belt" that was neither seal nor sea lion. The translation reads: "Its skin was dark, its extremities were flippers, its tail forked like a whale. A slight outline of round ribs was noticeable. We approached the animal, touched it and were surprised as its head bore an unusual form and its snout was long." When shown a drawing of a Steller sea cow, the fisherman stated that this was the animal—the same tail, fore flippers, and head—and he was surprised to learn that it presumably no longer existed.

Edward Mitchell, research biologist for the Canadian Department of Fisheries, has suggested that the unknown animal may have been a stray northern elephant seal. This large pinniped, whose usual range extends from Baja California to northern British Columbia, would fit the description: large in size, dark in color, and having a prominent snout. Its bipartite tail, if compressed, might have resembled a forked tail. The northern elephant seal has shown a tendency to wander thousands of miles from its normal centers of abundance. It has been seen at Prince of Wales Island, Alaska; at Midway Island in the mid-Pacific; and at Ugamak Island in the Aleutians, an area not far



From *Bering's Voyages*, by F.A. Golder. American Geographical Society, New York, 1922, 1925

from the sea cow's former grazing grounds in the Bering Sea.

Nonetheless, Mitchell believes that the extinct status of the Steller's sea cow is a presumption. He says: "There simply haven't been exhaustive inventories of marine vertebrates so that one could state unequivocably that this or any species does not survive." Rather than speculate further, he suggests that it would be a simple, albeit costly, effort to survey the area by ship. "While a lack of sightings may not resolve the issue," he says, "a confirmed sighting or a capture certainly would."

Aside from such reports, the sad fact remains that there is no hard proof that the Steller's sea cow survived, at least for very long, past 1768. Beyond this, the evidence is insubstantial—as elusive as the North Pacific mists. However unwittingly, it looks like humans struck the last blow and Steller's giant browser perished—the victim of human appetites. ☐

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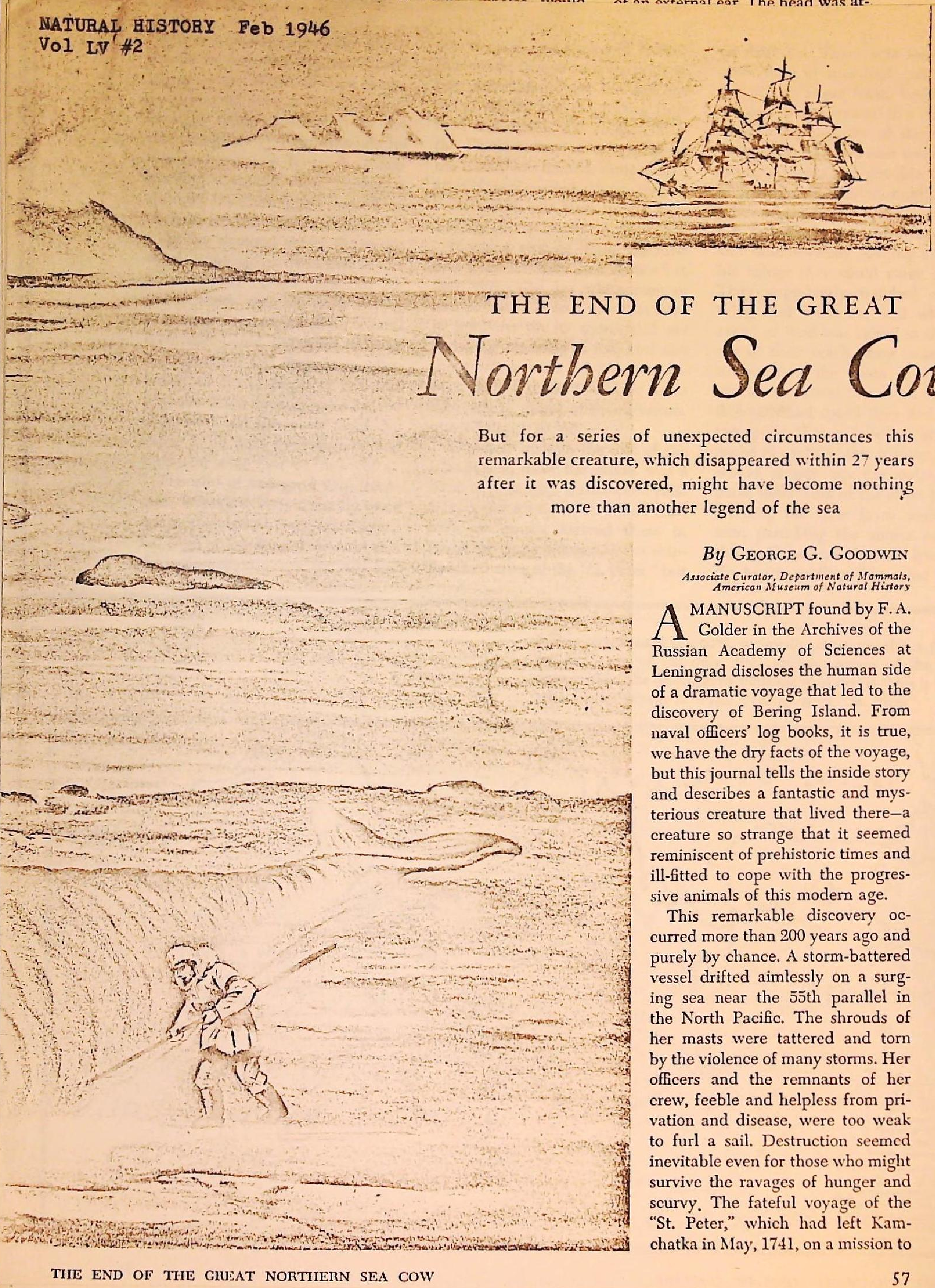


THE END OF THE GREAT *Northern Sea Cow*

But for a series of unexpected circumstances this remarkable creature, which disappeared within 27 years after it was discovered, might have become nothing more than another legend of the sea

By GEORGE G. GOODWIN

Associate Curator, Department of Mammals, American Museum of Natural History

A MANUSCRIPT found by F. A. Golder in the Archives of the Russian Academy of Sciences at Leningrad discloses the human side of a dramatic voyage that led to the discovery of Bering Island. From naval officers' log books, it is true, we have the dry facts of the voyage, but this journal tells the inside story and describes a fantastic and mysterious creature that lived there—a creature so strange that it seemed reminiscent of prehistoric times and ill-fitted to cope with the progressive animals of this modern age.

This remarkable discovery occurred more than 200 years ago and purely by chance. A storm-battered vessel drifted aimlessly on a surging sea near the 55th parallel in the North Pacific. The shrouds of her masts were tattered and torn by the violence of many storms. Her officers and the remnants of her crew, feeble and helpless from privation and disease, were too weak to furl a sail. Destruction seemed inevitable even for those who might survive the ravages of hunger and scurvy. The fateful voyage of the "St. Peter," which had left Kamchatka in May, 1741, on a mission to island especially where the the sea, the killer whales, would of an external ear. The head was at-

discover a passage across the North Pacific to America, was fast drawing to a close. When all hope of survival seemed gone, a cry of "*Land!*" brought renewed strength to the dispairing crew. Even though he was ravaged with fever, the Commander, Captain Vitus Bering, a stalwart Dane, dragged himself on deck to see the promised land.

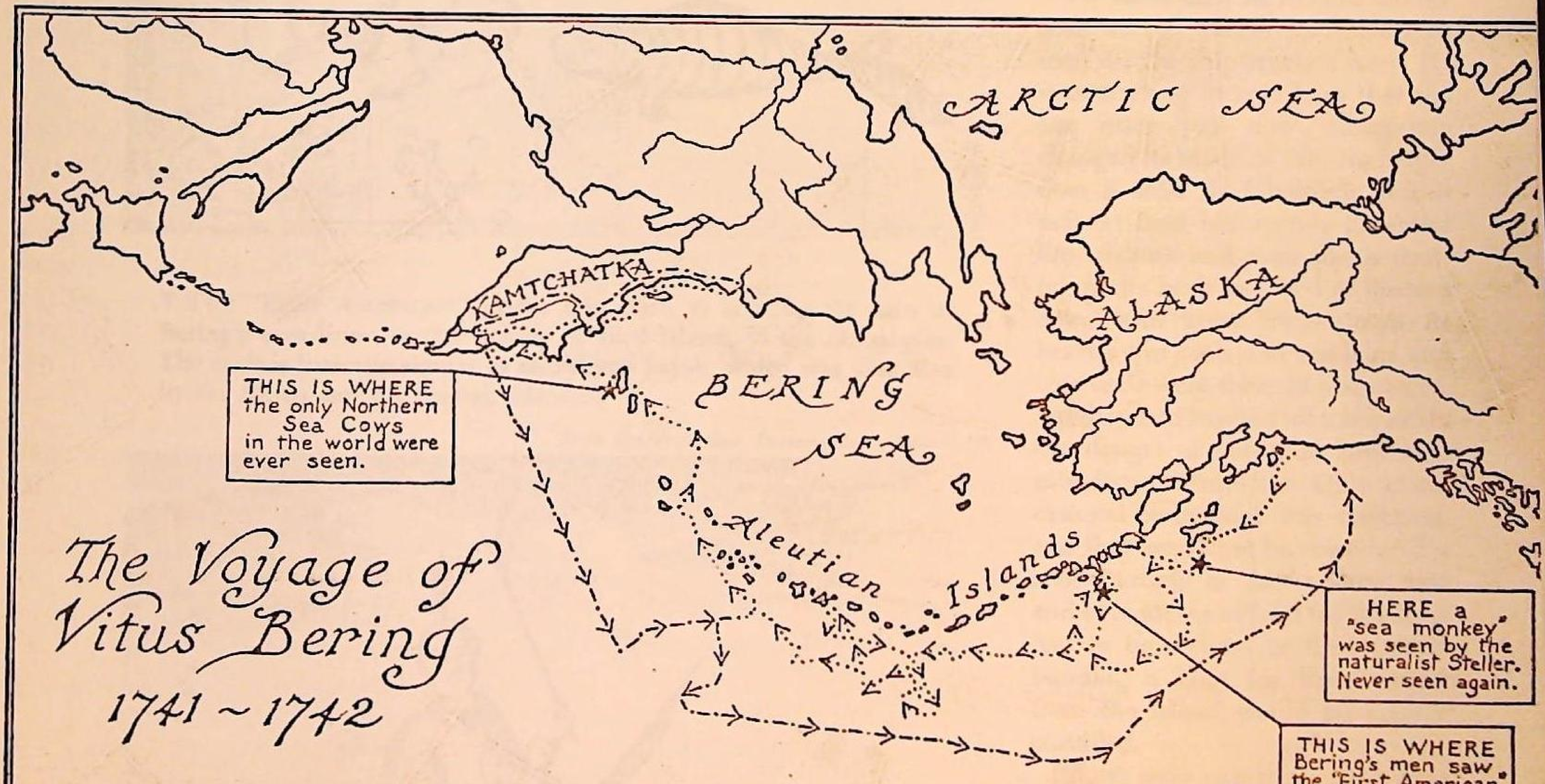
As the doomed vessel drove onward, hope again dwindled in the hearts of the valiant crew, for between them and the safe harbor breakers roared over a chain of fatal reefs that could but spell destruction for them and their craft. Mustering all the strength of the able few, two great anchors were heaved overboard but all to no avail. No cable could hold the vessel in that turbulent sea.

The end of the good ship, however, was not to be just yet. By some merciful power, a huge swell lifted her high at the crucial moment and she rode gallantly over the reef and into a calm and sheltered harbor. Immediate danger now over, all effort was made to get the sick and dying ashore and to procure fresh food and water. The tragic end of the Commander, in whose honor the island was named, came shortly after he was carried ashore, and the vessel itself was later hurled high and dry on the beach by a great sea.

It was a strange island paradise that these mariners had chanced to find, unspoiled by white man or native. The wild creatures that lived in harmony on its shores did not know the meaning of fear and met the visitors with bewildering expectation; but not for long were they left in doubt of man's unconquered desire to kill.

Strangely enough the first of the islanders to meet the sailors was a band of little blue foxes—close relatives of the Arctic White Fox, which had, no doubt, arrived there in much the same manner as the shipwrecked crew of the "St. Peter," but on drift ice. There was found no other form of true land animal on the island. These foxes, having no enemies, had increased to a number beyond the capacity of the island to support, and they now welcomed the newcomers as a possible source of sustenance. Unhesitatingly, they followed the sailors around, crowding into their tents and dugouts, and mischievously stealing all edible things they could carry away. They impudently watched everything that went on, and when a cache of food was raised in the air out of their reach, they cunningly undermined the posts so that it would fall down; then with incredible skill and speed they fled with the spoils. If they failed to bring a cache to earth in this manner, they would shinny up the poles and make short work of the store. Every morning the blue foxes could be seen patrolling the shores among the sea lions and fur seals lying on the beach, sniffing those that were

➤ THE NORTHERN SEA COW, drawn in company with a fur seal a
sea lion: one of the only three representations of the great ani
drawn under the direction of someone who saw it. This is from Wa
chart of the voyage of Vitus Bering's ship, "St. Peter"


ARCTIC SEA
KAMTCHATKA
ALASKA
BERING SEA
Aleutian Islands
PACIFIC OCEAN
THIS IS WHERE the only Northern Sea Cows in the world were ever seen.
HERE a "sea monkey" was seen by the naturalist Steller. Never seen again.
THIS IS WHERE Bering's men saw the "First American" depicted opposite Bird Island.
The Voyage of Vitus Bering
1741 ~ 1742
D.F. Levett Bradley - del.

the island, especially where the the sea, the killer whales, would of an external ear. The head was at-

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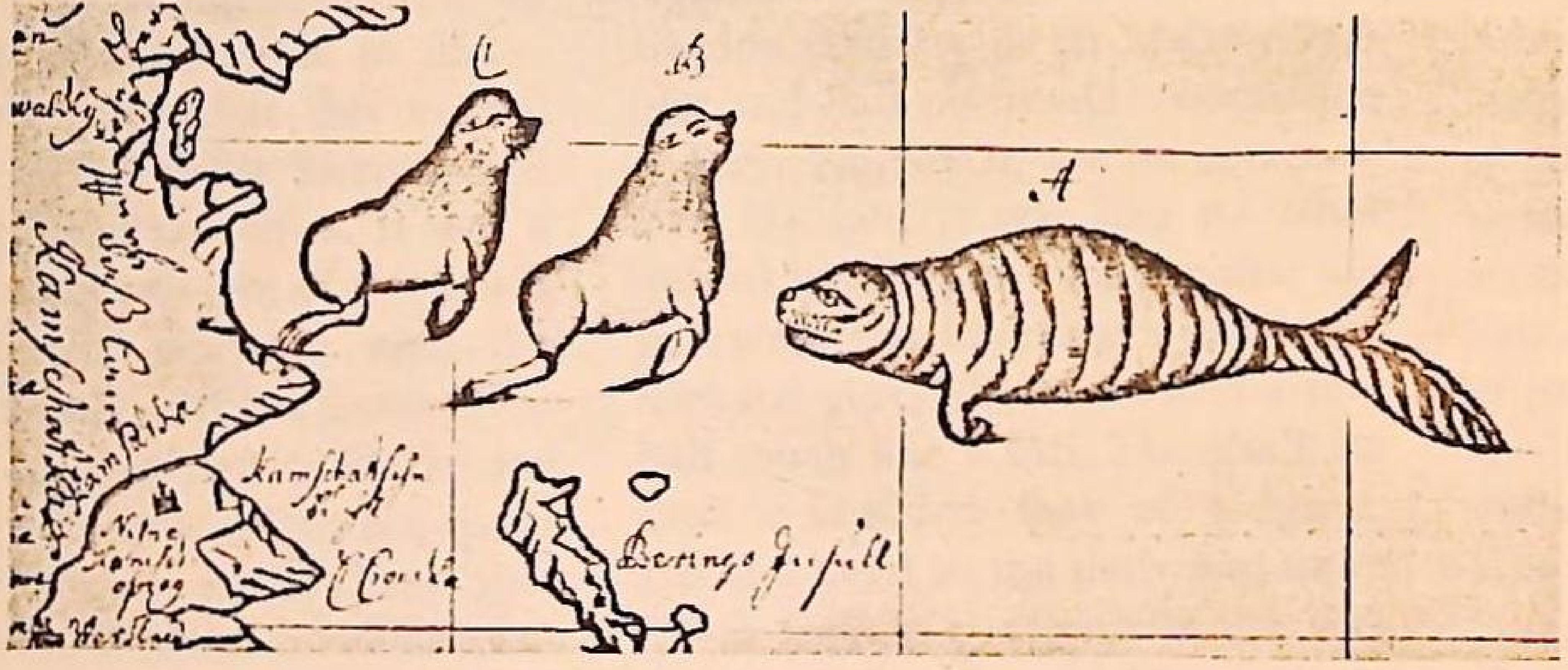
asleep to see whether or not there were any dead among them. They knew that it was not unusual for some of the baby sea lions to be crushed by their parents during the night.

It was not long, however, before their appetites wore out their welcome with the sailors and no amount of chastisement or torture could discourage or drive them away. A constant war ensued, but at fast as one batch of foxes was mercilessly killed another moved in to take its place. So bold did they become that they even attempted to tear a man's shoes from his feet. Small wonder that the foxes haunted the white man's camp and coveted his store of food, for they had been dependent on the morsels of food cast up by the sea and the few sea birds they could stalk.

Unfortunately the foxes served no practical purpose except as a garbage disposal corps. As food, their flesh was unpalatable. But the sea otter, present in large numbers, proved excellent eating. These otters lived singly and in pairs and herds, but just how many were seen together the manuscript does not state. Between November 6, 1741, and August, 1742, over 700 sea otters were killed and eaten on the island. These playful creatures hauled out on the rocks or open beaches to rest and sleep, or romped on the shore like children. Occasionally they extended their excursions half a mile or more from the water's edge. At first these animals, when asleep, fell easy prey to the sailors, who quietly stole in between them and the sea and then clubbed them as they tried to escape. The sea otters soon learned to distrust the invaders and kept constant watch, rarely settling down to rest without first surveying the beach in all directions for possible danger. Some that had apparently dozed off were seen to jump up with a sudden start and look anxiously around as if they had just remembered the presence of danger. Where a herd came ashore to rest, it became their custom to post a sentinel to keep watch. They seemed almost human in their habits and were pleasing to watch. Usually a family would congregate together, the male, female, half-grown young, and the nursing babies. The mother's love for her young was so strong that she unhesitatingly exposed herself to certain death rather than desert her offspring. In flight, the parents carried their young in their mouths, herding the older ones before them. If they had the luck to escape into the sea, they lost no time in mocking their pursuers in a very amusing manner, bouncing up and down in the water and throwing the babies in the air and catching them in their arms. They had a most fascinating manner of shading their eyes with a front paw as if to scrutinize more closely the men on shore. When a young sea otter was taken from its mother, she cried bitterly like a child, and if it was not returned she grieved so much that within a few days she became sick and feeble.

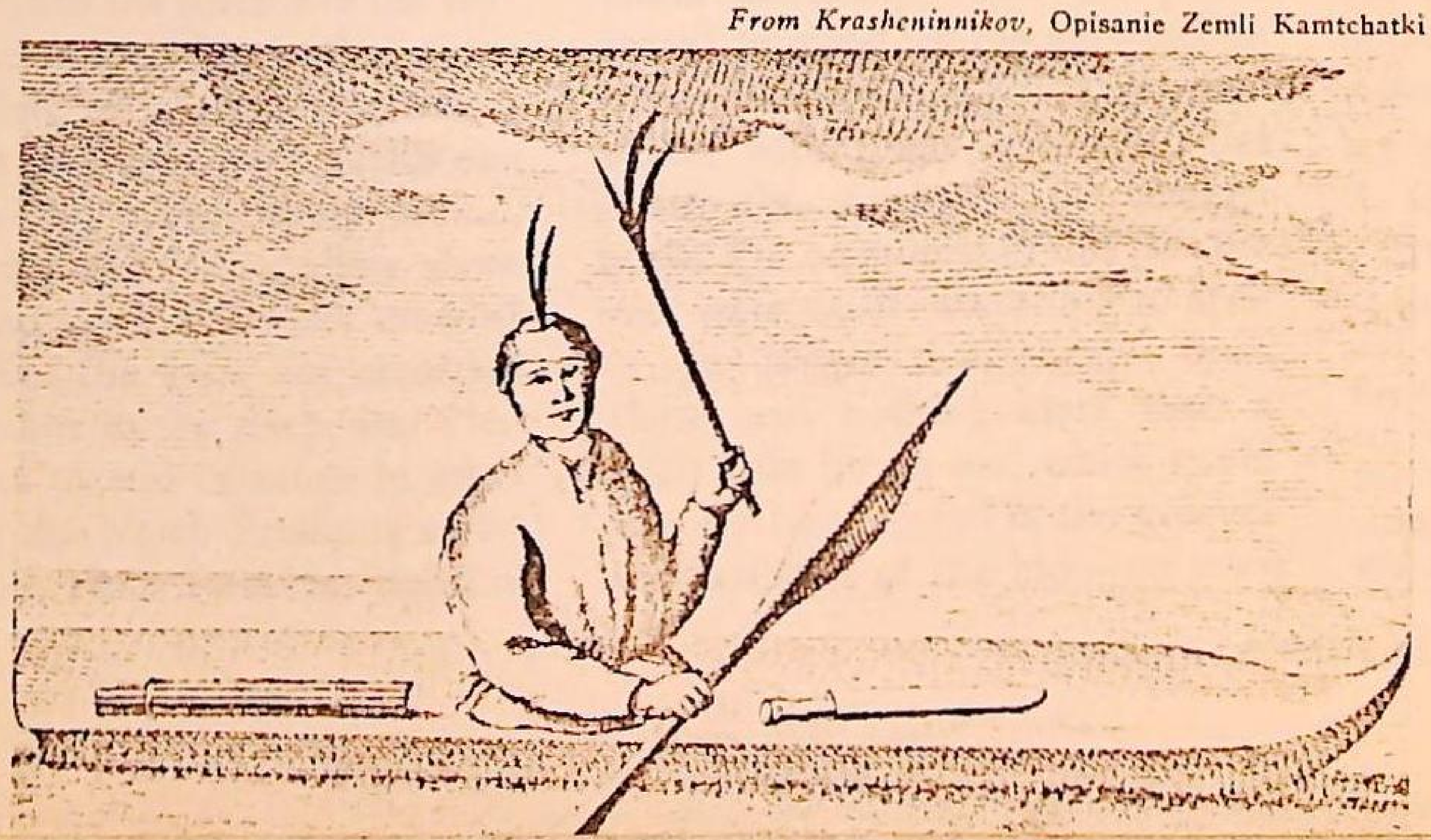
For more than six months the sea otter served almost exclusively as food for the shipwrecked crew. (It is interesting to note here that the sea otter has now completely changed its mode of life. No longer does it trust its fabulously priced pelt on land but spends its entire life offshore and even sleeps floating on its back in a bed of floating kelp, with arms folded over its heart.) Fur seals and sea lions and true seals were there in abundance, but they had learned all too quickly the danger of man and kept at a safe distance from him. Only an occasional individual was captured, and they could not be considered a staple article of food. Some new and easy source of food for the crew had to be secured or the work of building a boat for their escape from the island would be greatly curtailed.

Efforts were now made to capture a strangely fashioned creature that was browsing on the abundant seaweed growing along the shores of



▼ THE "FIRST AMERICAN" in his skin boat, as seen by the men of Bering's expedition in the vicinity of Bird Island, in the Shumagins. The craft is basically similar to an Eskimo kayak, which was used also by the Aleuts and the Kodiak Islanders

From Krasheninnikov, Opisanie Zemli Kamtchatki



the island, especially where the streams emptied into the ocean. The manuscript does not tell us what they thought of this strange form of animal life when it was first seen. Their amazement must have been truly great, however, when the first specimen was examined and found to be neither seal, porpoise, nor whale. Luckily, Commander Bering was accompanied on this fatal voyage by a German scientist, George Wilhelm Steller, the first and only trained naturalist that ever had an opportunity to study this amazing creature alive and in its natural surroundings. Steller carefully recorded his observations on its habits and gave a detailed description of its external and internal structure. Even at that, some of us now might well doubt that this was not the product of a fevered imagination were it not for the fact that Dr. Leonhard Stejneger collected skeletons of the animal on Bering Island in 1883 for the Smithsonian Institution. A skull from Stejneger's collection came to the American Museum of Natural History, where it can be seen today, exhibited on the third floor along with a small restoration of the animal in life.

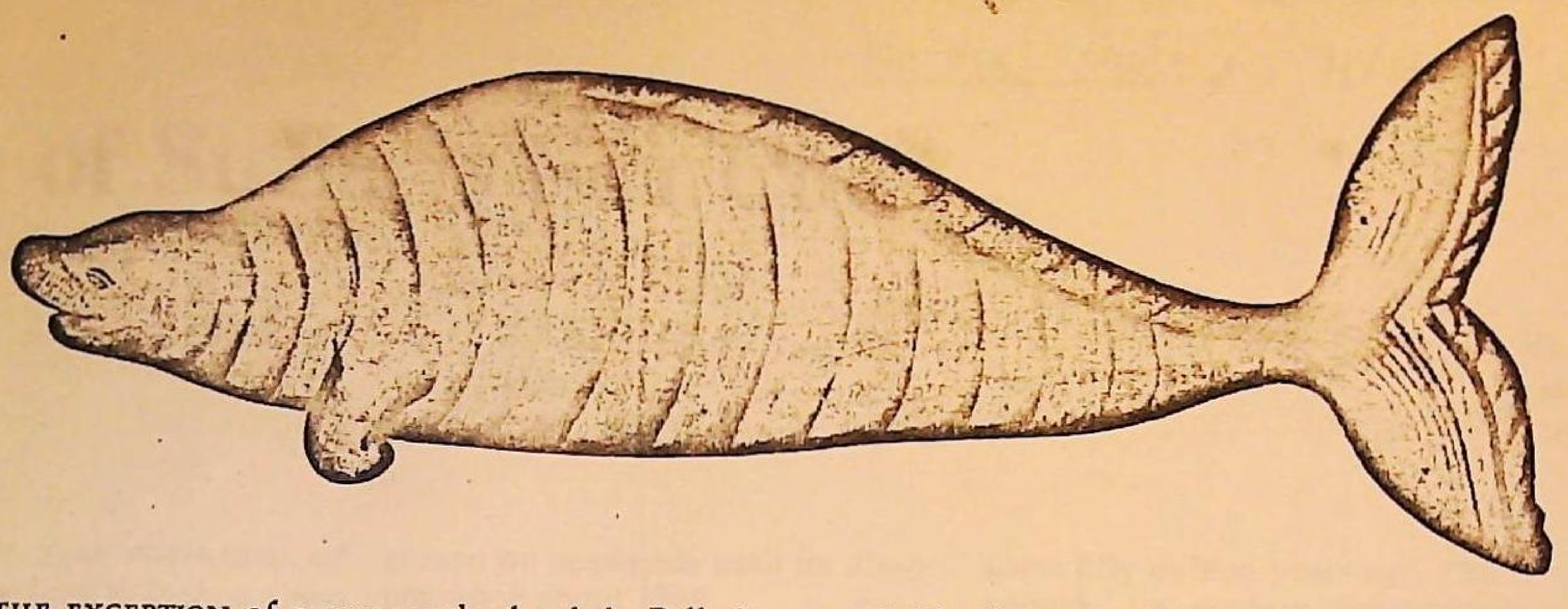
We know now that this animal belonged to the order Sirenia, and to the family of sea cows. It was a not too distant relative of the warm water Florida manatee and the African dugong and has been given the name of Northern or Steller sea cow. Its mysterious origin is a question that no one so far has been able to solve. Was it a lone survivor from an age when the Arctic basked in tropical sunshine and palm trees flourished in northern latitudes? Or did it belong to some great land mass that has long since disappeared below the surface of the sea? This much we do know, that never in the time of modern man has it existed anywhere except at this one tiny isolated spot, Bering Island, and then only in the shallow shore water and bays. It neither crawled ashore like the seals nor extended its activities to the deep sea. That it did not extend its range to other parts of the North Pacific is easily explained. Those ferocious tigers of the sea, the killer whales, would have made short work of such a defenseless creature were it to venture too far from the protective shallow shore waters.

Unfortunately, the Northern sea cow was completely exterminated within 27 years after it was first discovered. The only clear, firsthand information that we have about this animal is found in Steller's account. A drawing of the sea cow made under his direction was lost, but Waxel, a member of the navigation crew, shows a crude representation of the creature on his chart of the voyage.

From the skeletons now in the Smithsonian Institution we can figure that a full-grown animal had a length of 25 or 30 feet. This deduction corresponds closely with Steller's account, which gives the measurements of the largest specimen as four or five fathoms (24 to 30 feet) and their estimated weight as 200 Russian poods, or nearly four tons. Steller's description and measurements, while acurate in detail, leave a rather vague idea as to the general appearance of the animal. Apparently he never actually saw a Florida manatee or an African dugong and had no mental conception of these animals to use for comparison. He said it was like no other animal but had its own peculiar appearance. He described it as having forward parts like a seal and a rear half much like a fish. The skull, he said, resembled that of a horse; but the head in the flesh was more like a buffalo's, especially the lips. In place of teeth, which were lacking altogether, there were two strong horny plates, one of which was set in the palate and the other in the lower jaw in opposition to it. These obliquely furrowed plates served to grind up the seaweed on which the animal fed. The lips were armed with many strong bristles about the thickness of chicken quills. For an animal of this size the eyes were small—according to Steller, no bigger than sheep's eyes. There was nothing more than a small hole for an ear, which could scarcely be detected in the grooves and wrinkles of the hide—no trace of an external ear. The head was attached to the body by a short, thick neck. There were no hind legs, and the extraordinary front paws consisted of only two joints, with no fingers or nails. The extremity of each had the appearance of being amputated and was covered with coarse calloused skin and shaped much like a horse's hoof, doubled under in a hook. These clubfeet were of no assistance to the animals when swimming. They served to pull the huge body along in shallow water when the creature was grazing and were also used to knock seaweed from the rocks. The back of the animal, Steller says, was formed like that of an ox, with median crest or backbone, on either side of which was a flat or hollow space along the back; the flanks were rounded. The belly, he says, was rounded like a frog's and at all times stuffed full of seaweed. The tail became gradually thinner toward the flukes, which consisted wholly of fat and gristle, and were horizontal and forked like those of a whale or porpoise. The hide itself was peculiar. According to Steller, it was blackish-brown and had an outer covering about an inch thick resembling the bark of a tree, full of grooves, wrinkles, and holes, especially about the head. This warty surface apparently took the place of hair in other animals and consisted of perpendicular fibers clustered in the form of bulbs that fitted together into delicate cavities in the skin underneath, giving an appearance much like the surface of a thimble. The outer skin was easily broken loose and served to cushion the animal when it came in contact with the rocks.

Steller's notes on the habits of this sea cow perhaps give us a better conception of the beast than his description of its appearance and are given here as translated by F. A. Golder:

> "These animals, like cattle, live in herds at sea, males and females going together and driving the young before them about the shore. They are occupied with nothing else but their food. The back and half the body are always seen out of the water. They eat in the same manner as the land animals, with a slow forward



WITH THE EXCEPTION of a very crude sketch in Pallas' *Zoographia Rosso-Asiatica,* this is the only other representation of the Northern sea cow made under the direction of someone who had seen the animal. It was probably drawn by Plenisner and was included in the Waxel *Tsarkoye Selo* manuscript, subsequently published by Büchner. Bones of the animal and eyewitness accounts of it complete our knowledge of the extinct monster

movement. They tear the seaweed from the rocks with their feet and chew it without cessation. However, the structure of the stomach taught me that they do not ruminate, as I had at first supposed. During the eating they move the head and neck like an ox, and after the lapse of a few minutes they lift the head out of the water and draw fresh air with a rasping and snorting sound after the manner of horses. When the tide falls they go away from the land to sea but with the rising tide go back again to the shore, often so near that we could strike and reach them with poles from shore. They are not afraid of man in the least, nor do they seem to hear very poorly. Signs of a wonderful intelligence I could not observe, but indeed an uncommon love for one another, which even extended so far that, when one of them was hooked, all the others were intent upon saving him. Some tried to prevent the wounded comrade from being drawn on the beach by forming a closed circle around him; some attempted to upset the yawl; others laid themselves over the rope or tried to pull the harpoon out of his body, in which indeed they succeeded several times. We also noticed, not without astonishment, that a male came two days in succession to its female which was lying dead on the beach, as if he would inform himself about her condition. Nevertheless, no matter how many of them were wounded or killed, they always remained in one place.

"Their mating takes place in June, after protracted preludes. The female flees slowly before the male with continual turns about, but the male pursues her without cessation. When these animals want to take a rest on the water they turn on their backs in a quiet place in a bay and allow themselves to drift on the water like logs.

"These animals are found at all seasons of the year everywhere around the island in the greatest numbers, so that the whole population of the eastern coast of Kamchatka would always be able to keep itself more than abundantly supplied from them with fat and meat."

Steller's manuscript does not give any closer estimate of the number of sea cows at Bering Island or the size of the herds than that they were there in great numbers. Stejneger, who in later years visited the island and was familiar with the natural conditions there, figured that 1500 individuals would perhaps be too high an estimate. He said that it must be remembered that the Northern sea cow was a very large, bulky animal, 20 to 30 feet in length, and that it lived chiefly near the mouths of the rivulets, feeding on the seaweeds, especially *Lampellaris.* There are no more than 15 such places on the island; and if each of these were regularly visited by an average of 100 individuals, one would easily be impressed by their abundance, especially if they were divided into herds of from 10 to 20 individuals.

This story of the animals seen on Bering's last voyage would hardly be complete without some reference to the strangest and most fantastic of them all.

The precise manner in which Steller portrayed his observations inspires confidence in his work, but there is one section in the manuscript that, to say the least, is definitely puzzling. During the early part of this voyage Steller records seeing what he calls an unusual and unknown animal. For the lack of a better comparison he likens it to Gesner's *Simia marina danica* or sea monkey. He describes it as about 2 Russian ells (56 inches) in length, with a head like a dog, pointed erect ears, large eyes, and a long, hairy body, reddish in color. The tail, he said, was divided into two fins, like a shark's, the upper half being twice the size of the lower. It had long whiskers like a Chinaman and no fore limbs.

This so-called sea monkey followed the vessel for two hours, playfully bouncing in the water (sometimes in an erect position like a man) and diving swiftly under the bow of the ship. At times it followed so closely that it could be reached with a pole. Eventually it went off to sea but reappeared again on several occasions. The general assumption would be that this was a sea otter or a sea lion, but it must be remembered that Steller was too familiar with these animals to fail to recognize them. Furthermore, he had plenty of opportunities to examine the curious creature at close range. Needless to say, there is no animal either living or extinct known to science that comes anywhere near Steller's description.

Natural History 11/78
87: 9-17

Saga of Steller's Sea Cow

by Delphine Haley

The largest sea mammal of its kind was last reliably seen in 1768. Some sketchy Soviet sightings suggest it survives

The Steller's sea cow is the only North Pacific sea mammal to become extinct in historical times. Discovered in the winter of 1741–42, when explorer Vitus Bering's crew was shipwrecked on an island that would later bear their leader's name, this giant marine herbivore was literally devoured into oblivion because of its beeflike meat and sweet-tasting blubber. For twenty-seven years following its discovery, the sea cow was a major food source for Russian hunters seeking sea otter fur across the North Pacific. It lived only in the shallow waters off Bering and Copper Islands, in the Commander Islands some 100 miles east of Siberia in the Bering Sea. Slow-moving and unsuspicious, it grazed on seaweeds until its disappearance about 1768.

Georg Wilhelm Steller, the Bering expedition's naturalist and surgeon, was among the first to notice the sea cow. It resembled an overturned boat until it moved, when it revealed a huge, spindle-shaped body as much as twenty-five feet long, ending fore and aft with a disproportionately small, bristly muzzled head and a large, laterally lobed tail. We are indebted to Steller for the only scientific description of the sea cow—one of many species that bear his name.

The Steller's sea cow, along with the dugong and manatee, is a member of the order Sirenia. Although superficially resembling the modern whales and seals, the sirenians are actually descended from a pig-sized primitive ungulate, *Moeritherium*, which led a hippolike existence in the Upper Eocene some fifty million years ago. Oddly enough, its modern descendants, aside from the aquatically adapted sirenians, are the hyrax and the elephant.

Sirenians share a fusiform shape, a heavy-boned frame for stability, a horizontally flattened tail, a tough, wrinkled hide, bristly hairs around the lips, and a preference for coastal waters and estuaries where aquatic vegetation is abundant. They lack both an external ear and a dorsal fin. Two families—the manatee (Trichechidae) of the tropical Atlantic and Caribbean and the dugong (Dugongidae) of the Indian Ocean and East African and Indo-Malaysian waters—are the order's present representatives.

The sea cow, a dugongid, was the only recent family member to adapt

Adapted from *Marine Mammals of Eastern North Pacific and Arctic Waters*, ed. by Delphine Haley. Pacific Search Press; Seattle, Washington; 1978.

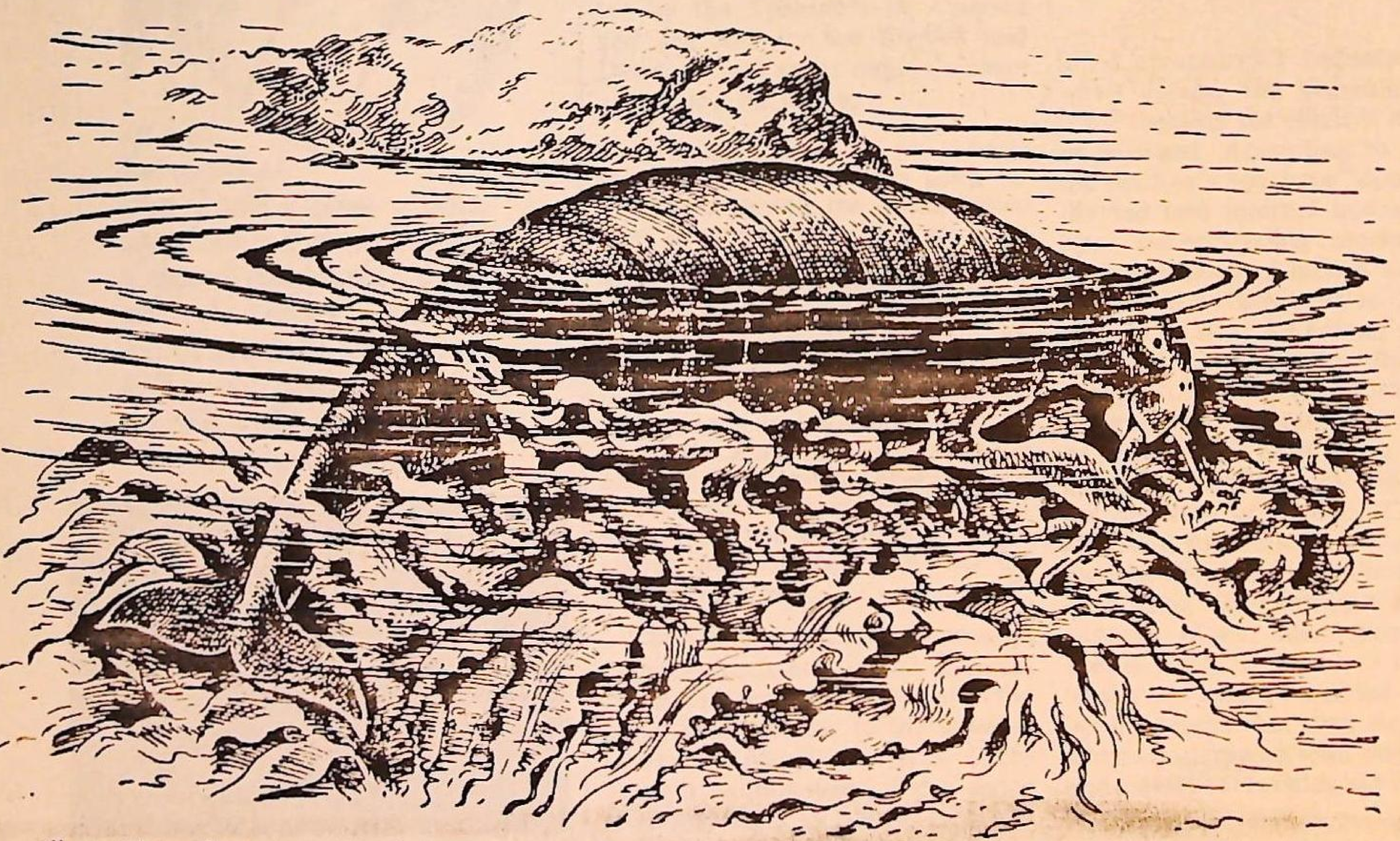


Illustration of a reputed Steller's sea cow

From the Soviet scientific journal *Priroda*, 1965

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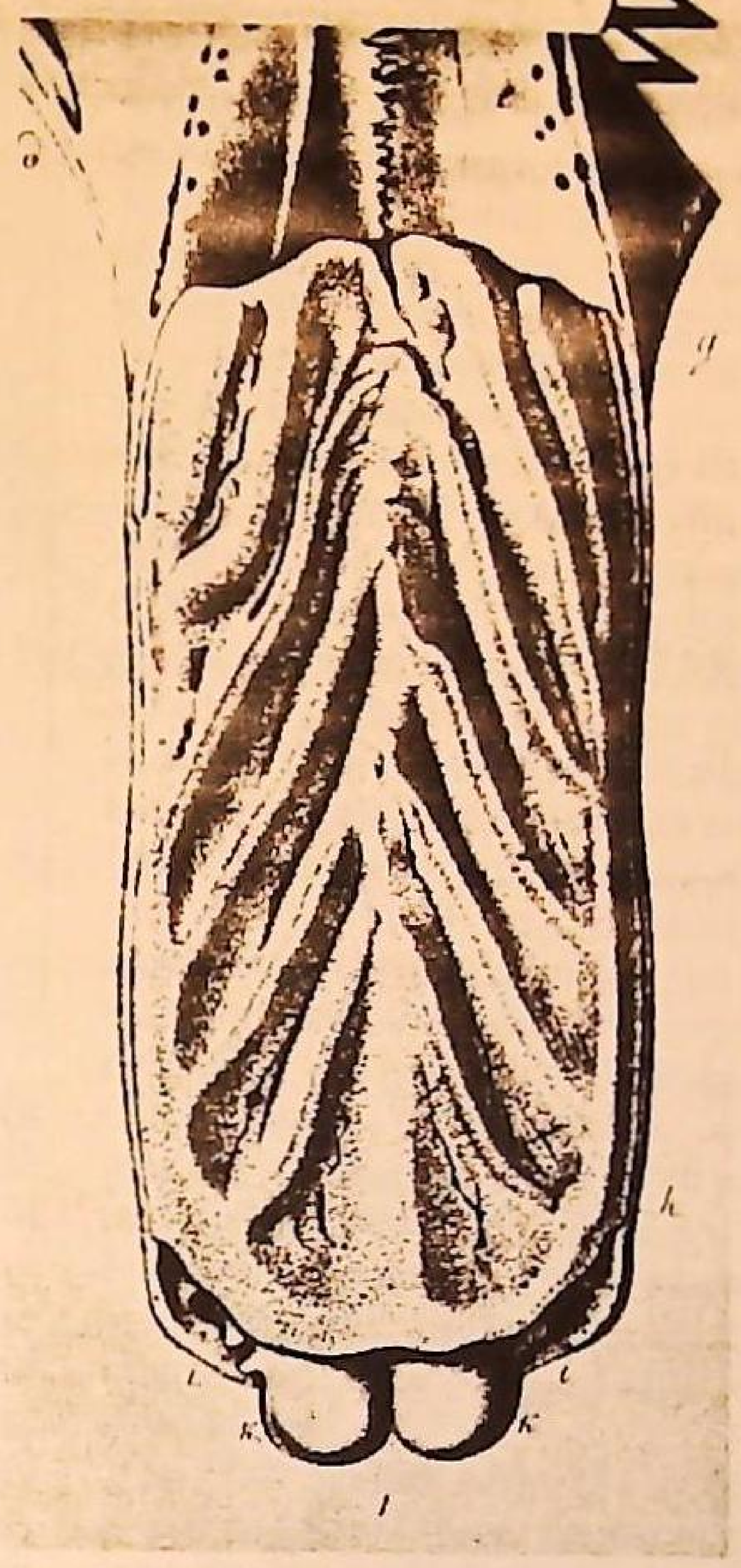
to the cold waters of the north. To accomplish this, it evolved distinguishing traits, which Steller described. The sea cow was by far the largest sirenian, up to twenty-five feet in length. Its weight is confusing, for Steller records it at "200 pud," or 4.5 tons, and "1,200 pud," or 26.8 tons. (Marine mammalogist Victor Scheffer, using a clay model of the sea cow, has calculated its weight at 7 tons for a sea cow some twenty-five feet long.) Four inches of fat—nine in some places—provided insulation from the cold, and an inch-thick hide furnished protection from the abrasions of ice and surf-pounded rocky coasts. Its hairless, black, elephantlike hide—sometimes marked with white spots and zones—displayed a very rough cuticle, particularly around the head, eyes, ears, breasts, and under the forelimbs. The hide was uneven, full of grooves, wrinkles, and funnel-shaped lesions, or pits, gnawed out by a parasitic amphipod later named *Cyamus rhytina*. Seagulls were known to sit on the sea cows' backs and feed on these parasites.

Steller's descriptions of the sea cow and other North Pacific sea mammals were published posthumously in 1751 by the Saint Petersburg Academy of Science under the title *De Bestiis Marinis*. He related the creature to the one called manatee by the Spaniards in America and sea cow by the English and Dutch. In noting its ungulate characteristics, he wrote,

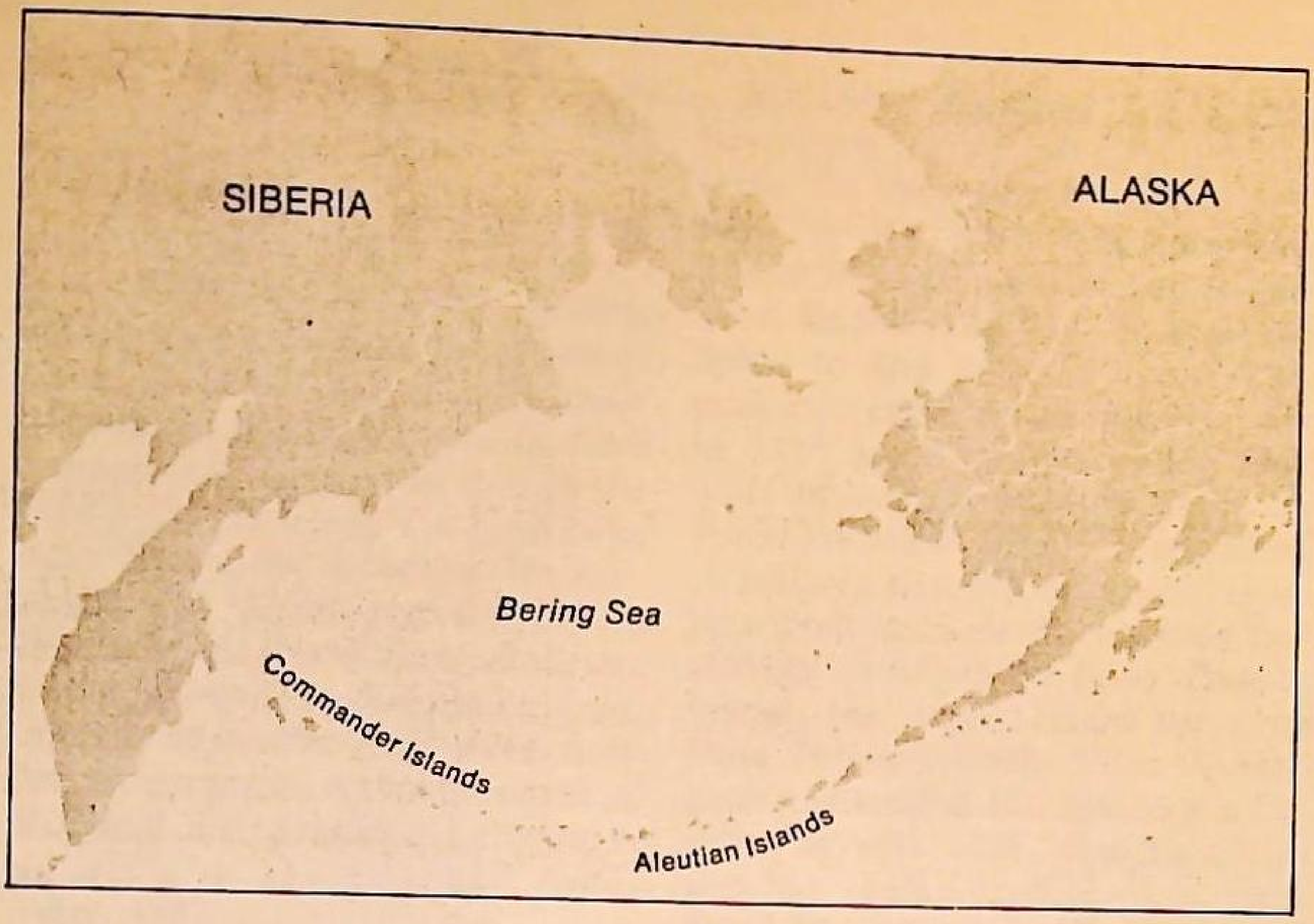
> These animals, like cattle, live in herds at sea, males and females going together and driving the young before them about the shore. They are occupied with nothing else but their food. The back and half the body are always seen out of the water. They eat in the same manner as the land animals, with a slow forward movement. They tear the seaweed from the rocks with the feet and chew it without cessation. . . . During the eating they move the head and neck like an ox, and after the lapse of a few minutes they lift the head out of the water and draw fresh air with a rasping and snorting sound after the manner of horses.



Rendering by J.F. Brandt of the chewing plates that took the place of teeth in the Steller's sea cow

From *Symbolae Sirenologicae*, 1849

The sea cow had several unusual physical features. Instead of teeth, two flat plates—one attached to the upper jaw, another to the lower—served as chewing organs. (Subsequent examination of the plates identified them as horny, tubercle-filled structures.) Indented with wavy canals, the chewing plates fitted together for efficient mashing of seaweed. According to Steller, the sea cow's lips were "double and divided into internal and external lips," the protruding exterior upper lip being fourteen inches wide and fringed with thick bristles. In spite of its huge size, the animal's lidless eyes were no larger than those of a sheep. Nor was there any trace of an external ear; instead, within the wrinkles of the skin, there was an opening "hardly large enough for the insertion of a pea." The two-foot-long forelimbs were used for moving about in the shallows or for supporting the enormous body on slippery rocks. Most peçuliar to Steller were the clawless forefeet, which he said resembled horses' hoofs, except that they were "furnished underneath with many short and closely set bristles like a scratch brush."



A few weeks before leaving Bering Island in August 1742, Steller was able to dissect a sea cow that had been caught a few days previously. The specimen, a female, measured twenty-four feet in length and twenty feet at its greatest circumference. Its heart weighed 36½ pounds; the stomach stretched six by five feet and was so stuffed with seaweed that four strong men with a rope could scarcely move it. The length of the intestinal tract, from pharynx to anus, was 5,968 inches, or almost twenty times the animal's length. Steller took forty-seven measurements as he charted an anatomical map of the external and internal organs. In a brief description, he said the bones seemed surprisingly large and dense.

Steller noted the sea cows' behavior as he watched them during his nine-month stay on the island. He described their preference for shallow and sandy places along the shore, particularly at the mouths of freshwater streams where they sometimes came in so close that he stroked their backs. They pastured in family groups—a male, a female, and a "little tender one"; the adults always keeping the calf in front or, when traveling in a group, guarding it in the midst of the herd. Steller believed they were monogamous, with mating usually in early spring and most of the single newborns appearing in autumn after a presumed gestation of more than a year.

The sea cow's docile disposition and slow-moving habits, its (presumed) low reproduction rate and limited distribution were its undoing. In addition, its single-minded appetite for certain seaweeds made it heedless of all danger. One could safely row a boat into their midst while they grazed with heads underwater. Furthermore, even an injured sea cow would do little more than move out from the shallow water and return later, apparently bewildered. Aware of these habits, the Bering crew set out in the calm seas of May to capture and kill the delicious food source floating offshore. Their early attempts failed, but in June 1742 they hooked a sea cow from a boat and pulled it in by rope, a feat requiring the efforts of forty men on land. En route the beast struggled and moaned softly. On subsequent occasions, when one of the herd was hooked, its companions tried to rescue the captive by pressing on the rope or upsetting the boat with their backs. Once landed, the immense animal was carved into sections. The resultant steaks were described as "exceedingly savory"; even more delicious to the malnourished crew was the fat, which tasted like sweet almond oil.

Several weeks after the first sea cow was killed, the crew set out in a rebuilt boat for their Russian homeland. They took with them a supply of sea cow fat and salted meat, and news of a fortune to be made in sea otter, fox, and seal furs—with a food source in the sea cow. For the next twenty-seven years, successive fur-seeking expeditions slaughtered the sea cow. According to Steller's biographer, Leonhard Stejneger, the animal was rarely killed outright; instead, the wounded sea cow usually died slowly of its wounds. Only one out of five killed was actually con-

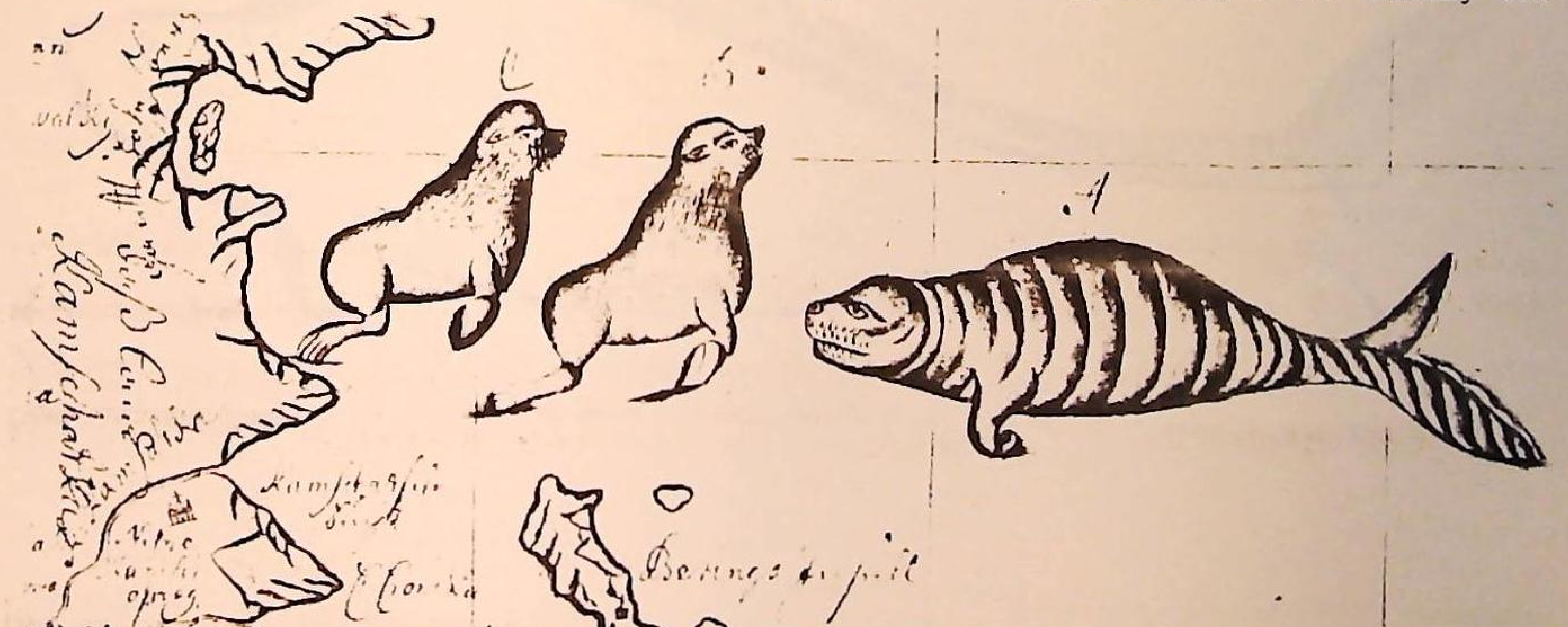


Chart section (attributed to Swen Waxell, an officer on Bering's 1741 expedition) depicting sea mammals of the Bering Sea: (a) sea cow, (b) sea lion, (c) fur seal sumed. In 1768 the last sea cow was killed, as recorded by explorer Martin Sauer.

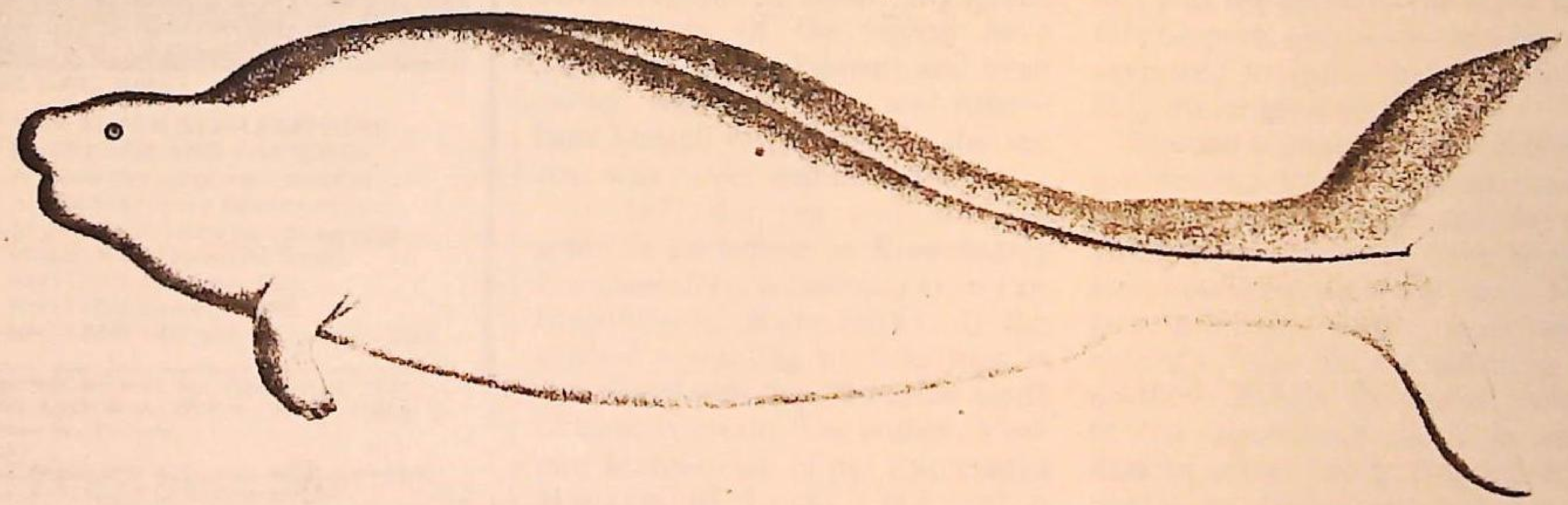
Stejneger, after one and a half years on Bering Island, determined that if the fifteen river mouths where the sea cows congregated were visited by herds of only fifteen or twenty animals, they would have seemed abundant, even though the total population may not have been more than a few hundred. He estimated the population on Bering Island in Steller's time at fewer than 1,500 and concluded that those animals seen after 1768 were stray female narwhals. As for the cause of the rapid disappearance, he wrote in an article in *The American Naturalist,* 1887:

> There can hardly be any doubt that these animals were the last survivors of a once more numerous and more widely distributed species, which had been spared to that late date because man had not yet reached their last resort. It is, then, pretty safe to assume that this colony was not on the increase, and that, under the most favorable circumstances, the number of surviving young ones barely balanced the number of deaths caused by the dangers of the long winters. Under this supposition, every animal killed by a new agency—in this case by man—represents one less in the total number.

Sea cow "sightings" since 1768 have been the subject of much dispute, yet they persist—fueled perhaps by the wish that somehow Steller's beast has managed to survive. Expeditions in 1772 and 1783 failed to find any sea cows. This probably came as no surprise, for in 1755 a petition had been filed with authorities in Kamchatka by Peter Jakovleff, a mining engineer, requesting that sea cow hunting be restricted because the animals had already disappeared from Copper Island and would soon be gone from Bering Island. Some investigators extended the sea cow's demise beyond 1768. Among them was Norwegian explorer A.E. Nordenskiöld, who visited Bering Island for five days in 1879. While there, he spoke with three natives who stated that they had seen animals of this description as late as 1854.

Even in recent years, there have been reports of sea cows in the North Pacific. In July 1962, a Soviet research vessel near Cape Navarin, northeast of the Kamchatka Peninsula, came within 300 feet of six very large, unusual-looking dark-skinned animals feeding offshore. They had relatively small heads and bifurcated upper lips, which, perhaps because of their thick whiskers, seemed to project beyond their lower lips. The animals, twenty to twenty-seven feet long, maintained a tight formation, swam slowly, dived at regular intervals for short periods, and emerged high out of the water. A similar animal was seen in the same area on the following day. In an article in the Soviet scientific journal *Priroda,* the authors (A.A. Berzin, E.A. Tikhomirov, and V.I. Troinin) state that this sighting was only the most recent of several that had been reported in the region. To show that such reports were not impossible, they added that since the 1950s two completely new marine mammal species had been discovered—the ginkgo-toothed whale and the Gulf of California porpoise.

As anticipated by the authors, the sea cow sighting was challenged, also in *Priroda* (1965), by Soviet zoologist V.G. Heptner, who labeled it another in a trend of reporting Loch Ness-like creatures. He noted a gap of 194 years between the last trustworthy sea cow sighting (1768) and the Cape Navarin report (1962), and asked, could such a visible animal, one whose back was usually exposed and on which seagulls often



Drawing of a Steller's sea cow attributed to Plenisner, Bering's clerk on the 1741 voyage

From Pallas' *Zoographia Rosso—Asiatica,* vol. 1, plate 30, 1826

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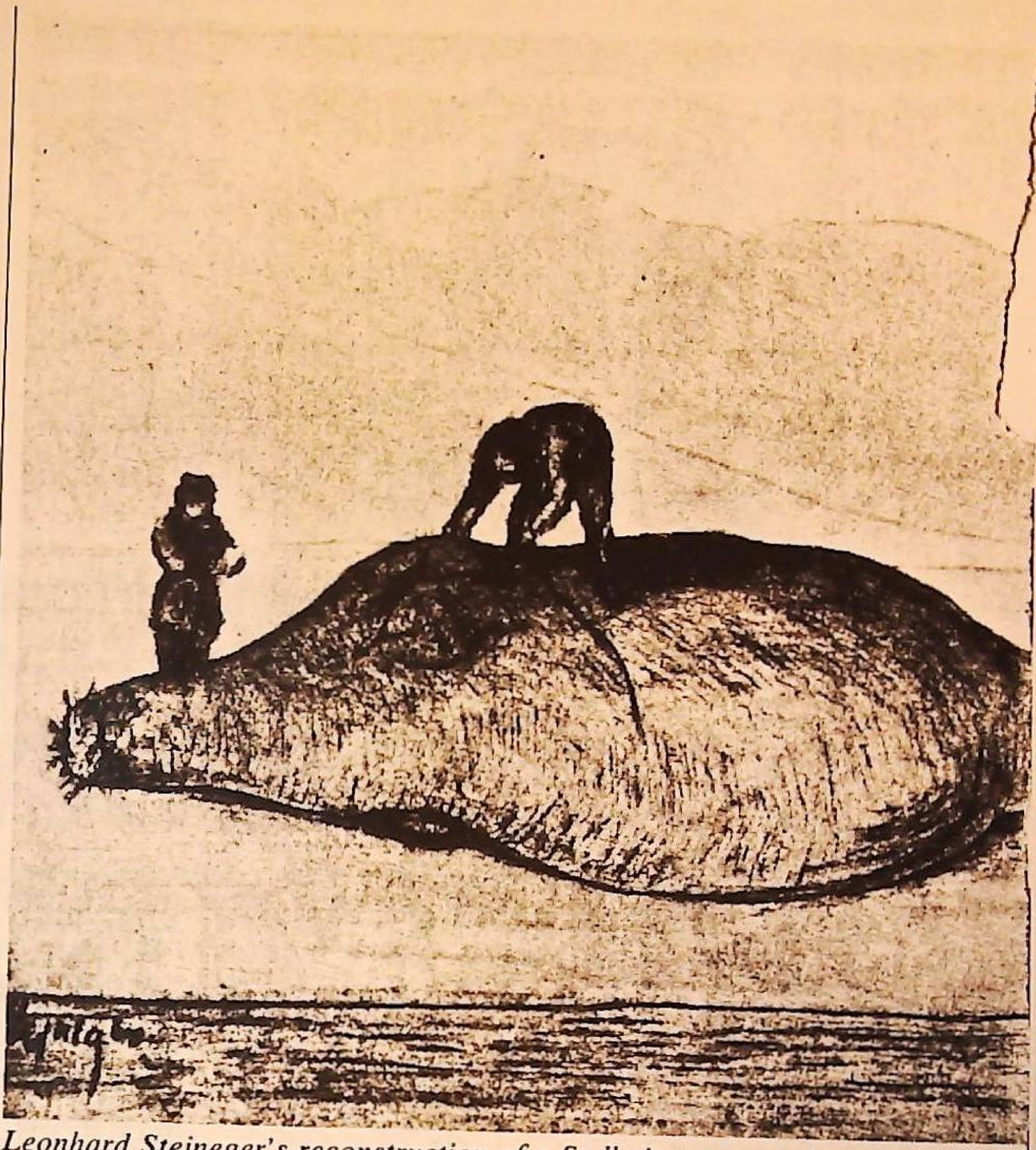
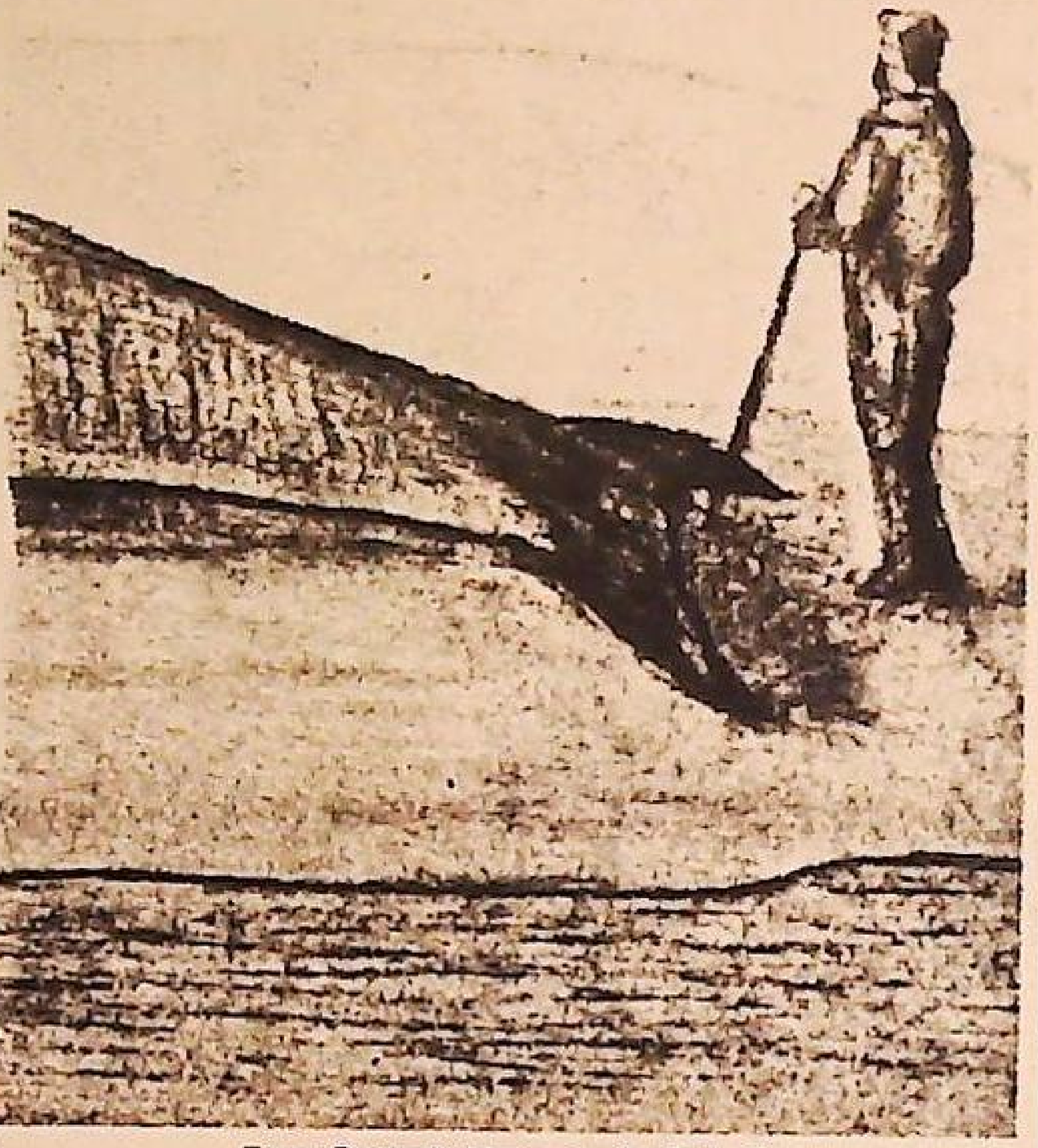


Leonhard Stejneger's reconstruction of a Steller's sea cow shows it being measured for the first time

perched, an animal that grazed near shore and left behind heaps of seaweed piled on the beach, have been overlooked all this time? Since the Soviet regime, he added, the faunal components of the region have been thoroughly known; and even earlier, when Russians and Americans hunted in the region, the sea cow was never mentioned.

In 1977 the sea cow surfaced again in an article in *Kamchatsky Komsomolets*, a newspaper in Petropavlovsk, Kamchatka. It described a sighting by fishermen in Anapkinskaya Bay, a region south of Cape Navarin. The author, Vladimir Malukovich of the Kamchatka Museum of Local Lore, interviewed one of the fishermen, who described an "unknown animal on a tidal belt" that was neither seal nor sea lion. The translation reads: "Its skin was dark, its extremities were flippers, its tail forked like a whale. A slight outline of round ribs was noticeable. We approached the animal, touched it and were surprised as its head bore an unusual form and its snout was long." When shown a drawing of a Steller sea cow, the fisherman stated that this was the animal—the same tail, fore flippers, and head—and he was surprised to learn that it presumably no longer existed.

Edward Mitchell, research biologist for the Canadian Department of Fisheries, has suggested that the unknown animal may have been a stray northern elephant seal. This large pinniped, whose usual range extends from Baja California to northern British Columbia, would fit the description: large in size, dark in color, and having a prominent snout. Its bipartite tail, if compressed, might have resembled a forked tail. The northern elephant seal has shown a tendency to wander thousands of miles from its normal centers of abundance. It has been seen at Prince of Wales Island, Alaska; at Midway Island in the mid-Pacific; and at Ugamak Island in the Aleutians, an area not far


From *Bering's Voyages*, by F.A. Golder. American Geographical Society, New York, 1922, 1925

from the sea cow's former grazing grounds in the Bering Sea.

Nonetheless, Mitchell believes that the extinct status of the Steller's sea cow is a presumption. He says: "There simply haven't been exhaustive inventories of marine vertebrates so that one could state unequivocably that this or any species does not survive." Rather than speculate further, he suggests that it would be a simple, albeit costly, effort to survey the area by ship. "While a lack of sightings may not resolve the issue," he says, "a confirmed sighting or a capture certainly would."

Aside from such reports, the sad fact remains that there is no hard proof that the Steller's sea cow survived, at least for very long, past 1768. Beyond this, the evidence is insubstantial—as elusive as the North Pacific mists. However unwittingly, it looks like humans struck the last blow and Steller's giant browser perished—the victim of human appetites. ☐

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ALASKA - the magazine of life on the last frontier
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ALASKA EARTHLINES TIDELINES page 26

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GONE FOREVER - OR IS IT ?

The sea cow wasn't as luckly as the fur seal . Within 30 years after the Russian discovery of Alaska in 1741 it was literally eaten up by waves of hungry fur hunters headed for the Aleutians .

Explorer Vitus Bering and his crew were the first to find the huge sea mammal when they were shipwrecked in the western Commander Islands on their way back to Siberia . Weak and starving they were ready to try anything. And they found to their great delight that its flesh tasted like beef and its fat like sweet butter .

Georg Steller , naturalist with the Bering expedition , left the only scientific description of the sea cow - one of the many Alaska species which bears his name . Like other plant-eating marine mammals, it was classified in the order Sirenia (sigh - REN-ee-uh) which in Latin means "mermaid ".

SOME MERMAID !

According to Steller's notes , it had a huge back body , 25 to 30 feet long , with a flat lobed tail at one end and a surprising small head at the other. Its short paddle-like forelimbs , used for moving about in the shallow waters , had no "finger bones" like the usual the flipper . Instead , Steller said they looked like hores hooves , except that they had "closely set bristles like a scratch brush " on the bottom.

The inch thick hide of the sea cow was wrinkled and rough like an elephant's and pitted withparasites , which were often picked out by the flocks of gulls perched on the sea cow's back . Its lidless eyes were no bigger thana dog's and its thick lips were fringed with bristles. Instead of teeth , it had two flat plates , grooved it fit together for mashing seawood.

But it was the sea cows appetite - and that of the Russians of course - that was its undoing Steller wrote .

"They are occupied with nothing else but their food ... They tear the seawood from the rocks with the feet and chew it without (stopping) ... Where they have been staying , even for a single day , there may be seen immense heaps of roots and steams . Some of them , when their bellies are full, go to sleep lying on their backs , first moving some distance away from shore so as not to be left on dry land by the outgoing tide .

They have such slight concern for their life and safely that one may pass in the very midst of them with a boat and single out from the herd the one he wishes to hook . Once hooked , Steller noted , it took some some 40 men to haul it in shore , while the animal moaned and struggled weekly . The last sea cow killing was recorded in 1768 , and the animal disappeared - the only North Pacific sea mammal to become extinct in historical times.

OR IS IT EXTINCT ?

Perhaps it is the only the wild hope that we didn't actually kill off an entire species . But from time to time over the past 300 years there have been vague reports of animals that just could be Steller sea cow.

In 1962 six strange looking animals were spotted by a Soviet research vessel near Cape Navarin northeast of the Kamchatka pensiula . And as recentlyas 1977 , a fisherman in the same general area got close enough to touch a huge creature stranded on a tidal belt , which he said had short flippers , a folked tail and an odd looking head / when shown a drawing of the Steller sea cow , the fisherman said that was it - and was surprised to hear that it " no longer existed."

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Cover: A clownfish (Amphiprion periderion) *takes refuge among an anemone's stinging tentacles on Australia's Great Barrier Reef. [Jeremiah S. Sullivan]*

THE GREAT NORTHERN SEA COW

Steller's Gentle Siren

by Delphine Haley

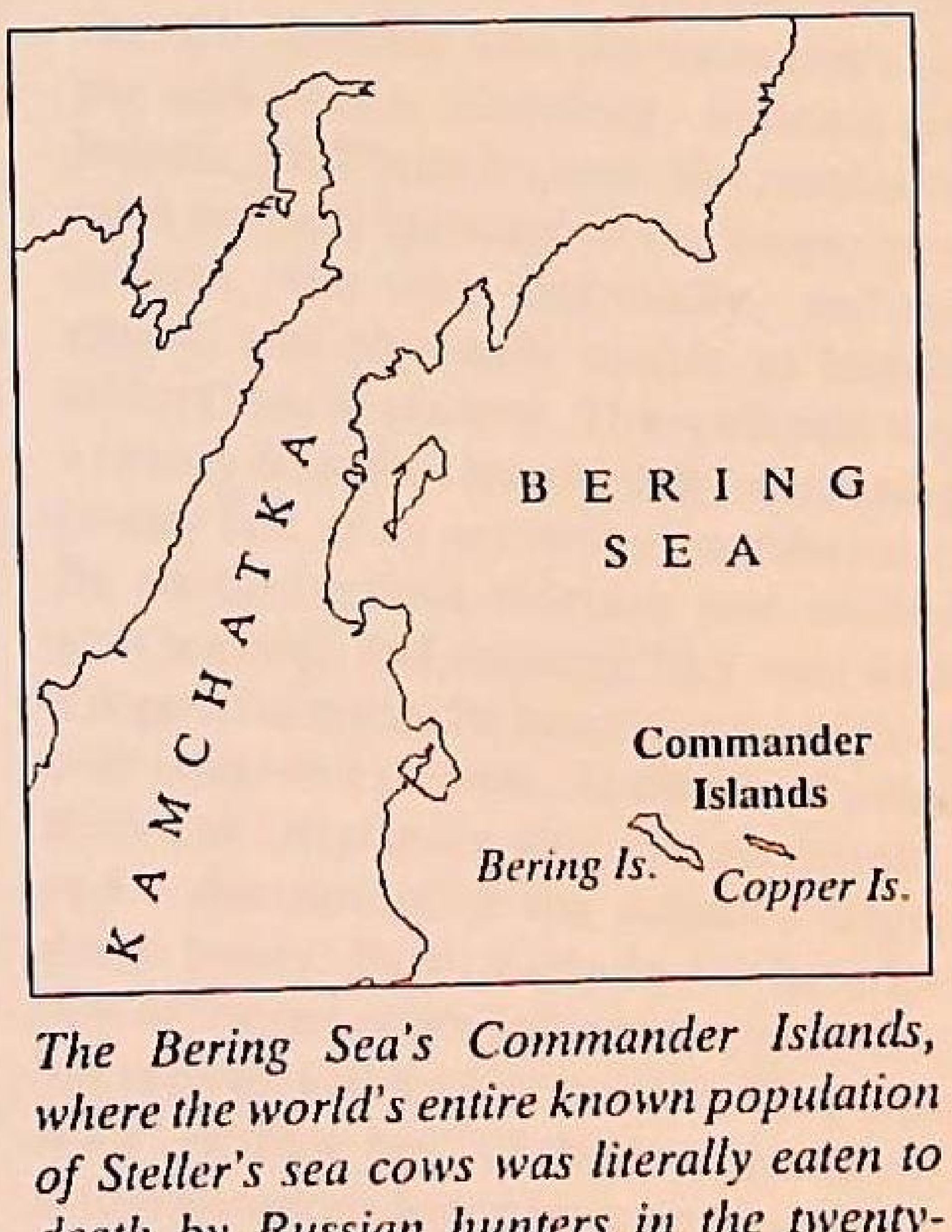
On a bleak November day in 1741, the crew of Vitus Bering's second expedition to North America surveyed the barren island on which they would be forced to spend the winter. Storms and scurvy had prevented their return to Petropavlosk on the Kamchatka Peninsula some 100 miles to the west. Instead, the diseased and hungry men were cast upon the shores of an island which would later carry the name of their leader, Bering, in an island group that would also celebrate his rank, Commander.

Georg Wilhelm Steller, the expedition's naturalist and surgeon, was among the first to notice a dark, humpbacked shape riding the swollen seas just offshore. At first it looked like an overturned boat; instead it proved to be a huge marine herbivore grazing among the kelps. In slow movements, the animal revealed a huge spindle-shaped body with a small head and large flukelike tail. Festooned with kelp, it lifted a bristly muzzle every few minutes for a snuffle and a benign look around. Thus did the Russian explorers meet up with the great northern sea cow—a creature that would serve them and others to follow as a food source until it became extinct twenty-seven years later. The story of the sea cow and its slaughter by humans bears retelling from time to time, for it illustrates both the unique traits of one mammal adapted to the sea and the swift predatory powers of another adapted to land.

Steller has provided us with the first and only scientific description of the great northern sea cow. Also called Steller's sea cow, it is one of many plant and animal species to bear the name of this inquisitive naturalist. German sailors dubbed the sea cow *Borkentier*, animal with barklike skin; and locals along the Kamchatka coast, where the bodies of sea cows sometimes washed ashore, called it *kapustnik*, or sea cabbage eater. In 1895 science formalized the sea cow as *Hydrodamalis gigas*, "giant among water cows". No number of names or identities, however, could secure the continued existence of this defenseless species.

When the forty-six survivors of Bering's original crew of seventy-eight returned to Kamchatka ten months later, they brought with them news of a fortune in furs from sea otter, fox, and seal—and a food source in the sea cow. Its meat was said to compare with beef; its fat tasted like sweet almond oil. Over the next twenty-seven years, fur-hunting expeditions sailed to the Commander Islands and killed off the approximately 1,500 sea cows that grazed in the shallows. By 1768, the species was extinct. Some have claimed that it survived beyond that date, and even in recent years unsubstantiated reports still perpetuate the wish that Steller's giant beast is not irrevocably gone.

The Steller's sea cow, along with the dugong and the manatee, is a member of the order Sirenia, a group which may have inspired the ancient myths of mermaids. The sirenians, although they look superficially like whales or seals, are actually related to the hyrax and the elephant; all descended from a common ancestor, an unknown ungulate beast that probably lived during the Paleocene roughly 60 million years ago. Sirenians share a heavy-boned frame, a horizontally flattened tail, a tough wrinkled hide, bristly hairs around the lips, and, in addition to teeth, plates in the mouth for chewing the vegetation of estuaries and coastal waters. They lack both an external ear and a dorsal fin. Two families survive today: the manatee (Trichechidae) of the tropical Atlantic and Caribbean, and the dugong (Dugongidae) of the Indian Ocean and African and Indo-Malaysian waters.



The Bering Sea's Commander Islands, where the world's entire known population of Steller's sea cows was literally eaten to death by Russian hunters in the twenty-seven years following its discovery in 1741. [Catherine Conner]

The Steller's sea cow, a dugongid, was the only recent member of its family to adapt to cold northern waters. Its evolution has been traced by paleontologist Daryl Domning in a comprehensive work entitled *Sirenian Evolution in the North Pacific Ocean*. Two ancestral stocks migrated to the Pacific through the ancient Central American Seaway, probably during the Miocene. One species, *Dioplotherium allisoni*, died out, probably, according to Domning, because of competition for increasingly scarce bottom plants. The other form, *Dusisiren reinharti*, evolved successfully. It survived into the Pliocene and Pleistocene by adapting to cold water and exposed coasts, where it fed on plants, particularly kelp growing near the surface.

The culmination of this line, *Hydrodamalis gigas*, inherited unique traits: a huge size (although estimates of length range from 24 to 35 feet, a maximum documented length for the animals at Bering Island, extrapolated by Domning from skull measurements, is 25.8 feet, with a weight of about 6.5 tons), four inches of fat, and an inch-thick hide as buffer against ice and rocky coasts. Because of its soft algal diet, it no longer needed teeth; instead two plates in the mouth sufficed for chewing. Nor did it have finger bones on the forelimbs; apparently loss of the slender digits of its ancestors produced a stubbier forelimb more suitable for movement along the bottoms of shallow bays.

Hydrodamalis's range during the Pleistocene extended along the North Pacific coast from Japan to Baja California, a distribution which coincides with that of the sea otter. Off the California coast, the sea cow browsed as "recently" as 20,000 years ago. Then, for reasons still unknown, it began to die out until, by the 1700s, it survived only at the Commander Islands. Domning proposes that the sea cow disappeared as a result of hunting by prehistoric man. It was easy to kill, and the hunter needed only a stout spear. Domning suggests further that such hunting may even have been a prelude to the most primitive form of North Pacific whaling, in which one struck the quarry with a poisoned lance and waited for the carcass to drift ashore. According to this theory, the sea cow may have been exterminated first along the more southerly coasts of Asia and America and so restricted to the less accessible—and least hospitable—parts of its range. No sea cow bones have yet been found at any archaeological site, but coastal middens of sufficient antiquity at lower latitudes have been covered over by recent rises in sea level. For further discoveries, Domning looks to the western Aleutians, where, if human occupation began recently enough, there may still be not only archaeological but even cultural evidence of sea cow hunting. (Given this theory, one might speculate even further: if aborigines also habitually took the sea otter that claimed the same range, the otters' removal may have increased the number of sea urchins. Sea urchins, in turn, may have depleted the kelp beds needed by the sea cow, and thus further contributed to restricting the sirenian's range.) Speculations aside, in only one remote refuge was the sea cow eventually to be found. And in time this too was discovered.

Steller's descriptions of the sea cow and other marine mammals were published posthumously in 1751 by the Saint Petersburg Academy of Science under the title *De Bestiis Marinis*. He had immediately recognized the species's relationship to the manatee and also saw some resemblances to the ungulates:

> *These animals, like cattle, live in herds at sea, males and females going together and driving the young before them about the shore. They are occupied with nothing else but their food. The back and half the body are always seen out of the water. They eat in the same manner as the land animals, with a slow forward movement. They tear the seaweed from the rocks with the feet and chew it without cessation. However, the structure of the stomach taught me that they do not ruminate, as I had at first supposed. During the eating they move the head and neck like an ox, and after the lapse of a few minutes they lift the head out of the water and draw fresh air with a rasping and snorting sound after the manner of horses.*

The creature had a tough, elephantlike hide, black except for occasional white areas. Around the eyes, ears, breasts, and under the forelimbs, the hide was wrinkled and pocked with lesions from a parasitic crustacean that often attracted sea gulls to perch and feed on the giant's exposed back.

Its teeth were absent entirely; instead it had

> *. . . in place of teeth two wide . . . bones, of which one is fastened above to the palate, and the other to the inside of the lower jaw. Both are provided with many obliquely converging furrows and raised welts with which the animal grinds up the seaweeds, its usual food.*

Its lips were "double and divided into internal and external lips." The protruding exterior upper lip, fourteen inches broad and fringed with thick bristles, prevented any food from falling out of the mouth. Its lidless eyes were very small, as was the ear opening on either side of the head. With emphasis on the blunt fingerless forefeet—which Steller considered the sea cow's strangest feature—the naturalist completed a verbal sketch:

> *The feet consist of two joints, the extreme end of which has a rather close semblance to a horse's hoof; they are furnished underneath with many short and closely set bristles like a scratch brush. With these front feet, on which neither fingers nor nails can be distinguished, the animal swims ahead, knocks the seaweeds from the rocks on the bottom, and, when lying on its back getting ready for mating, one embraces the other as with arms. . . . The median crest of the backbone is raised up high. Next to this [projection] on both sides there is a flat, hollow along the back. The flanks are oblongly rounded. The belly is so full that at the slightest wound the entrails at once protrude with much whistling. . . . From the genitals on, the body suddenly decreases greatly in circumference. The tail itself, however, becomes gradually thinner towards the flipper, which serves as hind feet; yet immediately in front of the flipper it is still two feet wide.*

Before leaving Bering Island, Steller dissected a sea cow, although he was hindered by many inconveniences: cold and rain, fluctuating tides, and the attacks of arctic foxes that tried to steal not only the sea cow flesh but also the naturalist's paper and books. Moreover, Steller's few helpers, paid from his own slim resources, were not only ignorant of the proper procedures, but also unfriendly, undisciplined, and physically unable to handle several tons of sea cow. The specimen was a twenty-four-foot long female, measuring twenty feet at its greatest circumference. Its six-by-five-foot stomach was stuffed with seaweed and required four men with a rope to move it. Its heart alone weighed over thirty-five pounds. At the site, Steller recorded forty-seven vital measurements, and a description of the animal's large, dense bones. Particularly in his description of the sea cow's soft anatomy, Steller has reconstructed a lost species. His notes are a "fleshing out" of the few pieced-together skeletons found in museums today.

STELLER ALSO OBSERVED the behavior of live sea cows. He noted their love for sandy, shallow places near shore, particularly at the mouths of fresh-water streams, where he could actually stroke their backs with his hand. He believed that they were monogamous and described their mating behavior:

> *Their mating takes place in June, after protracted preludes. The females flees slowly before the male with continual turns about, but the male pursues her without cessation. When, however, the female is finally weary of this mock coyness she turns on her back and the male completes the mating in the human manner.*

Most of the single newborns appeared in autumn, indicating a gestation of more than a year. The family bond was strong: they pastured together, male, female, and "little tender one", and the parents always guarded their calf in the middle of the herd.

Slow-moving habits, a docile disposition, low reproduction rate, and restricted range all combined to bring about the sea cow's final disappearance. Also, sea cows had a single-minded (and simple-minded?) taste for certain seaweeds which they sought with no regard for danger. Steller noted that they were gluttonous and that they kept their heads underwater with slight concern for their security. One could row a boat among them and select the next animal to be killed.

Thus, with the milder weather of May, the Bering crewmen began to eye the easy prey floating offshore. A month later, after several unsuccessful attempts, they caught the first sea cow with a large iron hook. It took forty men to haul it in.

> *The harpooner stood in the bow of the boat with the hook in his hand and struck as soon as he was near enough to do so, whereupon the men on shore, grasping the other end of the rope, pulled the desperately resisting animal laboriously towards them. Those in the boat, however, made the animal fast by means of another rope and wore it out with continual blows, until, tired and completely motionless, it was attacked with bayonets, knives and other weapons and pulled upon land. Immense slices were cut from the still living animal, but all it did was shake its tail furiously and make such resistance with its forelimbs that big strips of the cuticle were torn off. In addition it breathed heavily, as if sighing.*

On subsequent occasions, members of the herd tried to rescue the captive. Some attempted to upset the boat with their backs; others pressed down on the rope to break it, or tried, by blows of the tail, to remove the hook from the wound. Steller was especially moved by the devotion of mated pairs:

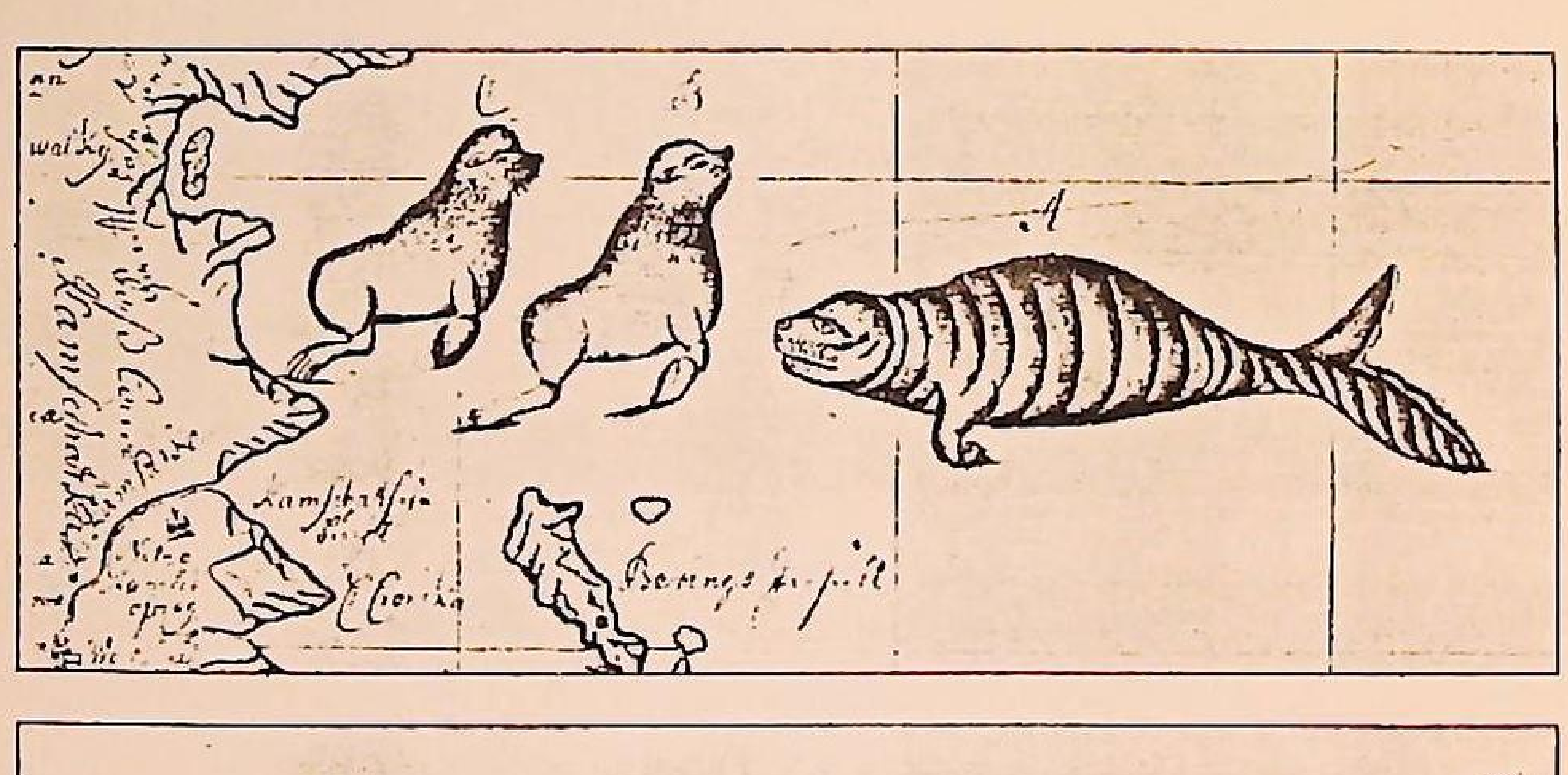
> *It is a most remarkable proof of their conjugal affection that the male, after having tried with all his might, although in vain, to free the female caught by the hook, and in spite of the beating we gave him, nevertheless followed her to the shore, and that several times, even after she was dead, he shot unexpectedly up to her like a speeding arrow. Early next morning, when we came to cut up the meat and bring it to the dugout, we found the male again standing by the female, and the same I observed once more on the third day when I went there by myself for the sole pupose of examining the intestines.*

After months of eating sea otter meat and flour soaked in sea water, the sea cow steaks must have tasted delicious indeed. Equally attractive to the malnourished men was the fat, which was "so sweet and delicious that we lost all desire for butter." And there was plenty to eat: one cow could yield 7,000 pounds of food.

Six weeks after taking the first sea cow, the crew set out for their homeland in a rebuilt boat. (Steller wanted to bring along a skeleton and skin of a young sea cow but there was no room on board. He brought back only his notes and a pair of the palatal plates.) The survivors brought back word of treasure for the taking and, in subsequent years, the Commander Islands became headquarters for expeditions pursuing sea otters for fur and sea cows for food.

There was only one recorded attempt to stop the slaughter of the giant sirenians. In 1755 a petition was sent to authorities in Kamchatka by Petr Yakovlev, a mining engineer, who requested that sea cow hunting be restricted. The animals were now gone from Copper Island, the petition stated, and would soon be gone from Bering Island. Yakovlev blamed as most wasteful not the larger hunts for provisioning ships (in which the sea cow was harpooned from a boat), but rather the small parties on the shore:

> *. . . since a man from among them [the hunters] from shore, or going out not far into the sea, stabs . . . and mortally wounds one or another cow; but those wounded cows go out to sea, and there, when they become exhausted from their wounds, then the sea does not wash up their meat on shore quickly and for a long time after the stabbing each cow if not cut into flat pieces will sour and become useless as food.*



Top: This section of chart, attributed to an officer on Bering's 1741 expedition to North America, depicts sea mammals of the Bering Sea: the sea cow (A), sea lion (B), and fur seal (C). Bottom: Although an observant naturalist, Steller was unable to make recognizable drawings of his subjects and had the commander's clerk, Plenisner, sketch them. This sea cow illustration is probably based on his lost originals.

Unfortunately, Yakovlev's attempt at conservation was ignored. The last sea cow was slain, according to Martin Sauer's report, on Bering Island in 1768.

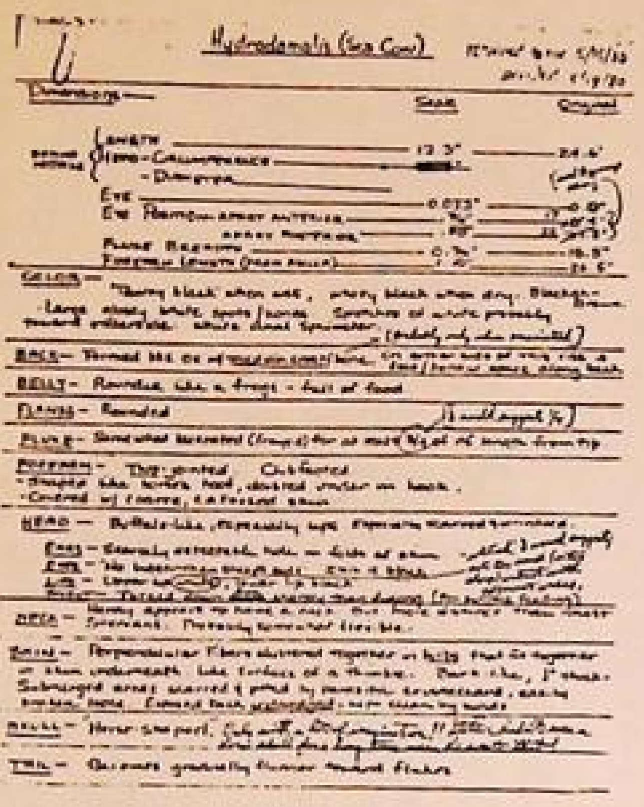
Some people have tried to extend the date of the sea cow's demise. Norwegian explorer A. E. Nordenskiöld, from interviews with natives on Bering Island, claimed that the death year should be changed to 1854. However, Leonhard Stejneger, Steller's diligent biographer, dismissed this and other later dates, concluding that Nordenskiöld's secondhand reports were probably of stray female narwhals. The biographer also estimated that during the years of wasteful hunting only one out of five sea cows slain was actually consumed.

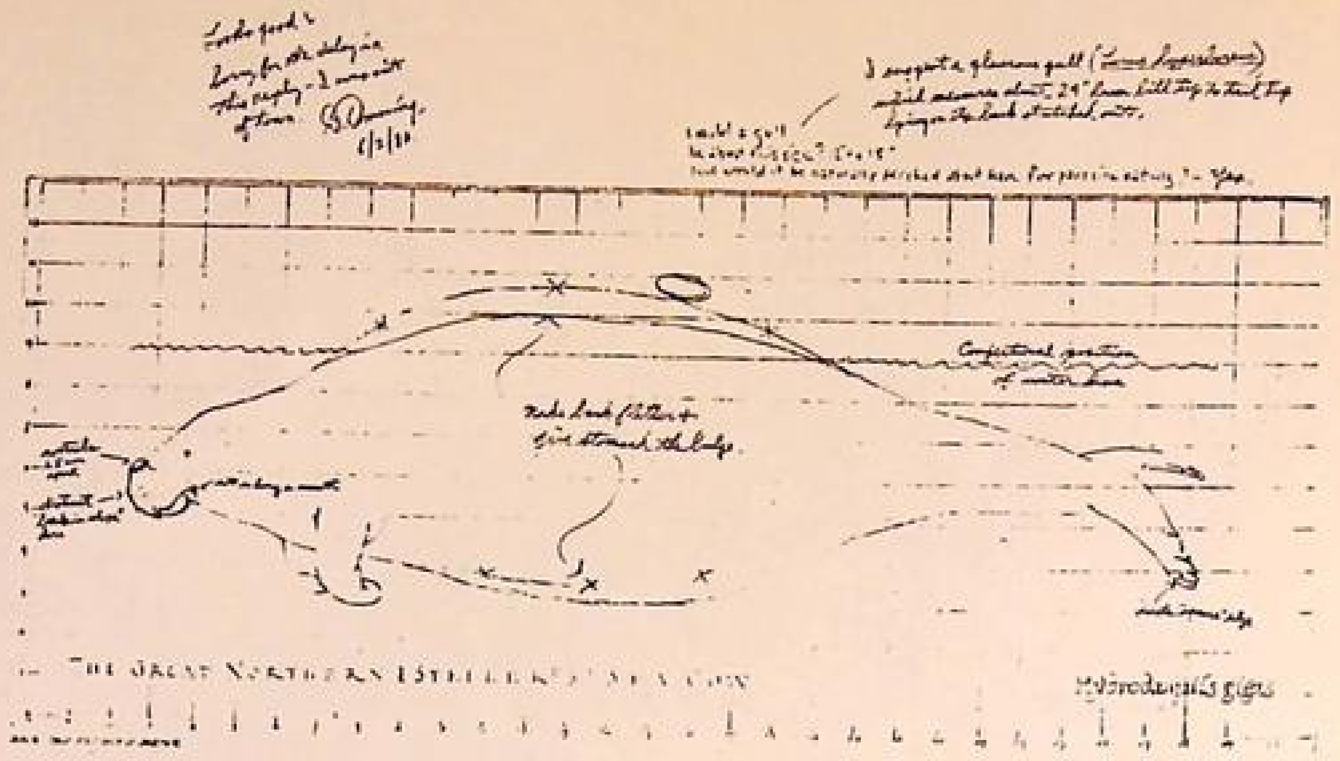
Stejneger deduced the same conclusion that paleontologists are proving today, that the sea cow was already declining when civilized man discovered it. In an article in *The American Naturalist* (1877), he wrote that since the sea cows tended to congregate near the mouths of the fifteen or so rivers along Bering Island, fifteen or twenty of these huge beasts may have appeared more numerous than they actually were. He estimated the population in Steller's time at less than 1,500 and states:

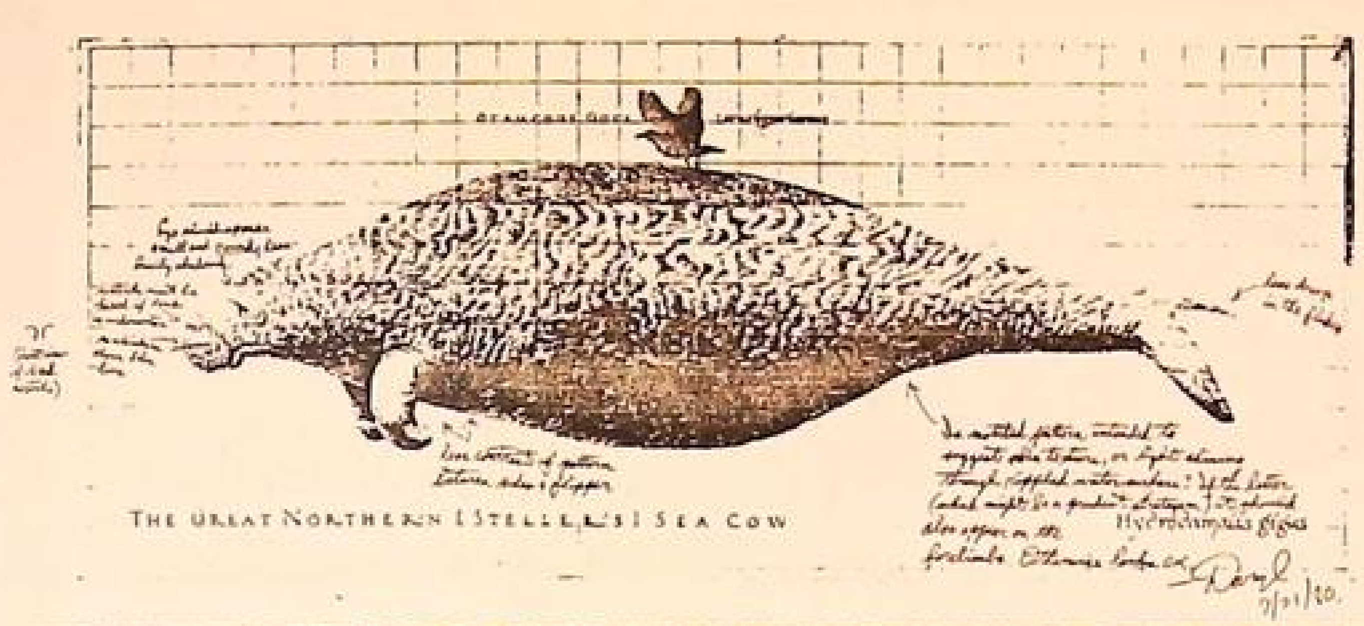
> *There can hardly be any doubt that these animals were the last survivors of a once more numerous and more widely distributed species, which had been spared to that late date because man had not reached their last resort. It is, then, pretty safe to assume that this colony was not on the increase, and that, under the most favorable circumstances, the number of surviving young ones barely balanced the number of deaths caused by the dangers of the long winters. Under this supposition, every animal killed by a new agency—in this case by man—represents one less in the total number.*

Over the eons, the Steller's sea cow had met evolutionary challenges overcome by no other sirenian. The prize of survival in cold waters had been dearly won. Ironically, the sea cow's very adaptations brought it close to man—who unwittingly struck the last blow. And thus the gentle sirenian survivor of 20 million years disappeared.

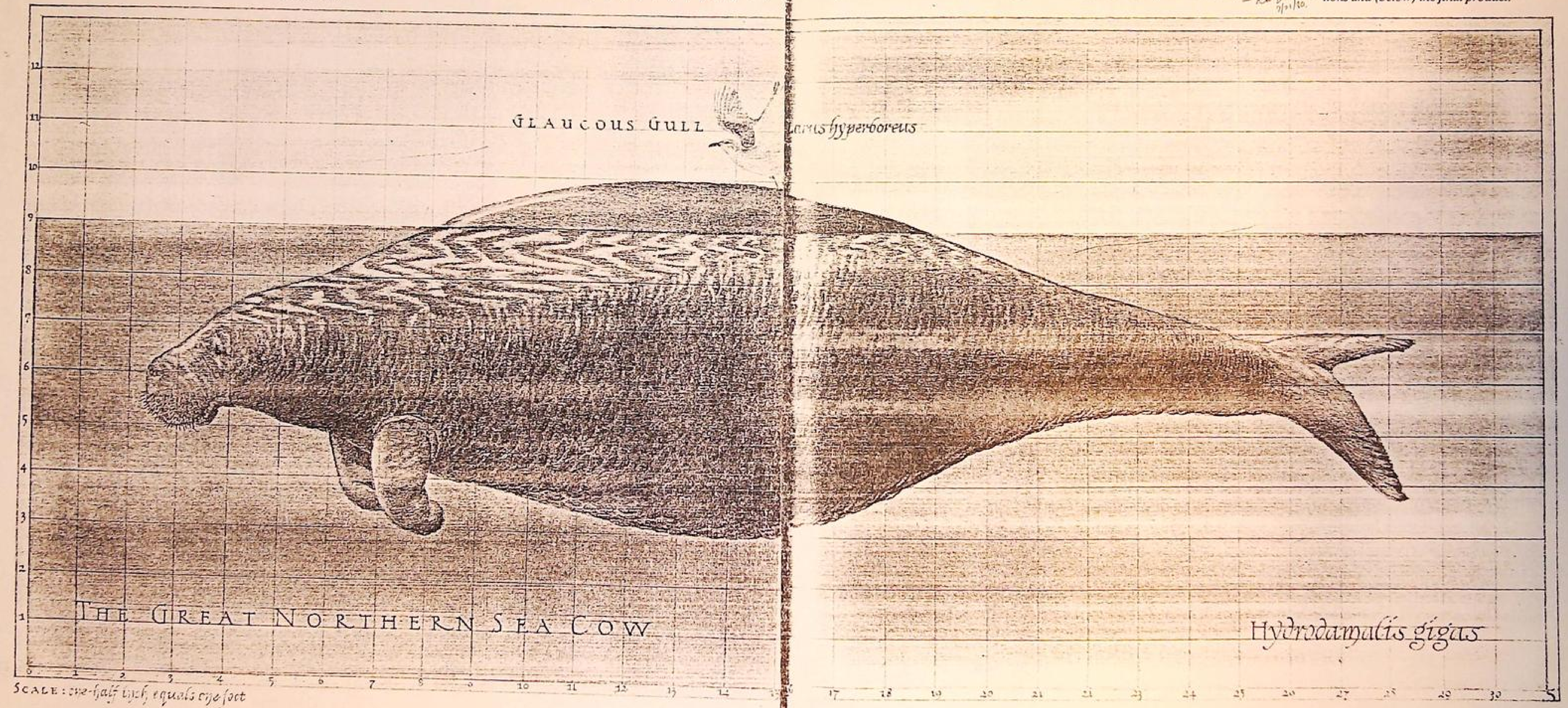
Delphine Haley's writings on natural history have appeared frequently in many publications. She is editor of the book Marine Mammals, *published by Pacific Search Press.*


Hydrodamalis (Sea Cow)
Length
12.3"
24.6'
COLOR
BACK
BELLY
FLANKS
FLUKE
FOREARM
HEAD
NECK
SKIN
SKULL
TAIL


Looks good!
Sorry for the delay in this reply — I was out of town.
D. Domning
6/3/80
I suggest a glaucous gull (Larus hyperboreus) which measures about 29" from bill tip to tail tip lying on the back stretched out.
Conjectural position of water line
Make back flatter & give stomach the bulge
THE GREAT NORTHERN [STELLER'S] SEA COW
Hydrodamalis gigas


GLAUCOUS GULL
Larus hyperboreus
THE GREAT NORTHERN [STELLER'S] SEA COW
Hydrodamalis gigas
Daryl
7/21/80

Anatomy of a reconstruction: *Although Steller provided exhaustive physiological and behavioral descriptions of the sea cow, no reliable drawings survive. For the 200 years since the species's demise, most illustrations have been modeled after its living relatives, the dugong and manatee. Culling statistics from various source materials (far opposite), and working some five months under the technical supervision of sirenologist Daryl Domning,* OCEANS *designer Dugald Stermer used watercolor dyes and pencil to flesh out the written accounts into the most accurate possible depiction of the animal. Pictured at left are two of the five working drawings with Domning's corrections and (below) the final product.*


GLAUCOUS GULL
Larus hyperboreus
THE GREAT NORTHERN SEA COW
Hydrodamalis gigas
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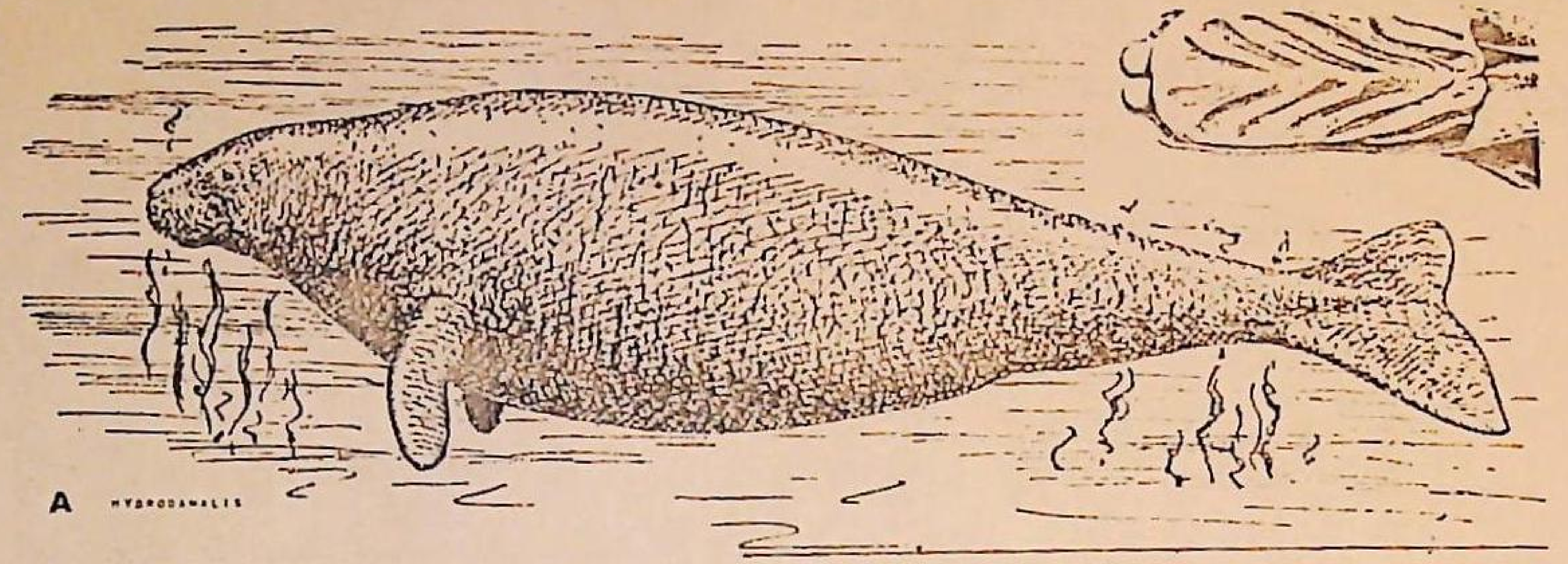
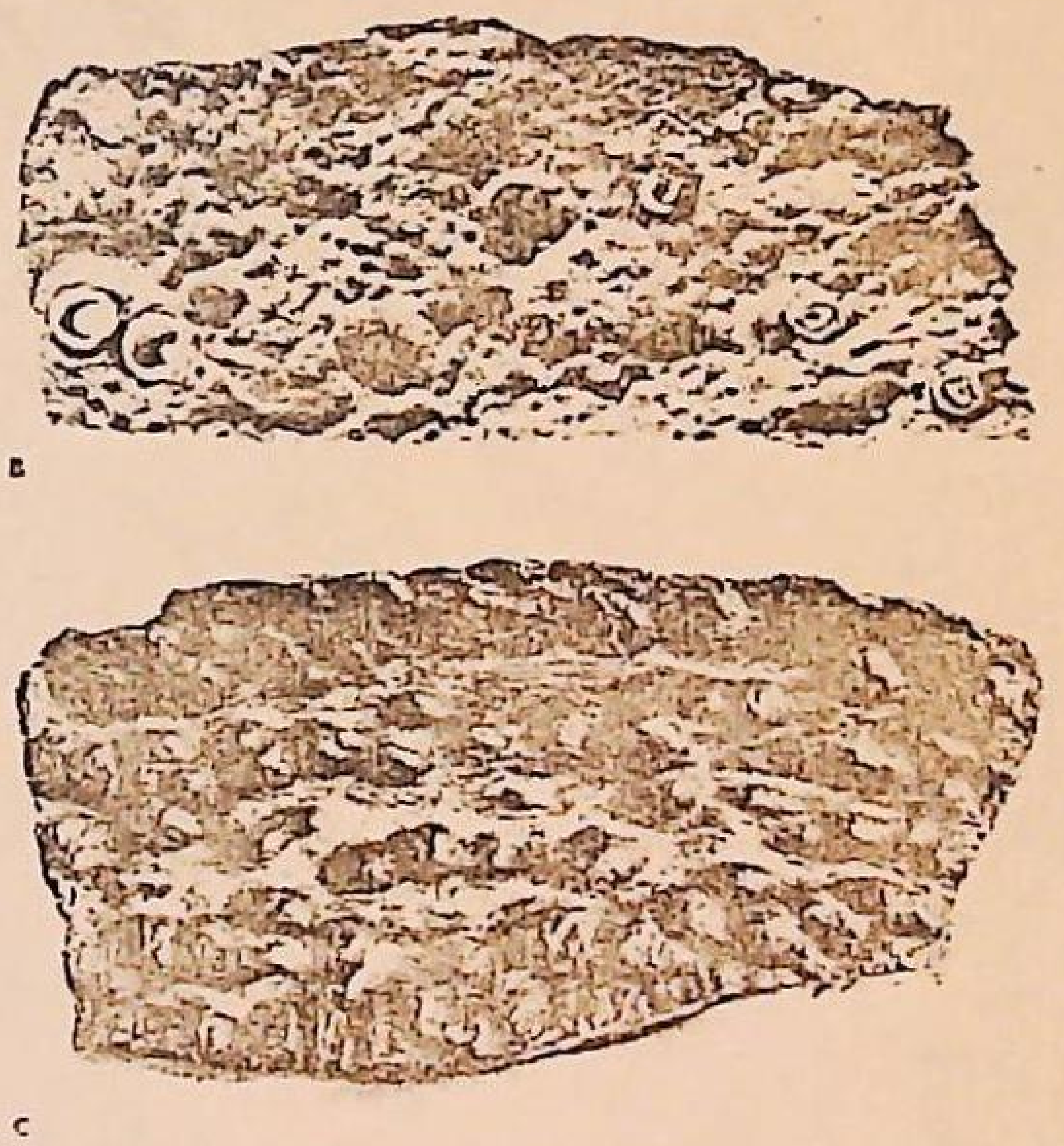
SCALE: one-half inch equals one foot





Steller's Sea Cow (*Hydrodamalis stelleri*), A. Photo from *Extinct and Vanishing Mammals of the Western Hemisphere*, Glover M. Allen. Inset: Steller's Sea Cow's palate, from *Symbolae Sirenologicae*, drawing by J. F. Brandt. B. Outer surface of skin; C. Flesh side of skin; photos by Erna Mohr.

STELLER'S SEA COW.

NOW EXTINCT, this huge, dugong-like creature (*H. gigas* = *H. stelleri*) had an extremely restricted range; it was confined to the waters around Bering Island and other small islands in the Komandorskie group in the Bering Sea. It was discovered when an expedition led by Captain Vitus Bering in 1742 was stranded on the island with most of the men sick with scurvy. Due to man's subsequent relentless slaughter for food and other purposes, it became extinct about 27 years after its discovery.

This animal was the largest of the Recent sirenians. From notes and data taken from observations of the living animal by Georg Steller, the famous German naturalist of Bering's trip, we can get an idea of the size and appearance of the animal in life. It measured 752 cm. from the tip of the nose to the point of the tail flipper. Its greatest circumference measured 620 cm. Steller estimated an adult female weighed about 4,000 kg. The head was small in proportion to the body. The tail had two pointed lobes forming a caudal flipper. The forelimbs were very small, flipper-like, and somewhat truncated. There were no hind limbs externally, no trace even remaining of the pelvic elements. The skin was naked and was covered with a very thick, bark-like, extremely uneven-appearing epidermis, from which the German name for this animal, "Borkentier," was derived. The skin was a dark brown to gray-brown color, occasionally spotted or streaked with white. The forelimbs were covered with short, brush-like hairs. Some dried pieces of this skin are still preserved, one in Leningrad and one in Hamburg. These animals were parasitized by two or three species of small crustaceans that burrowed into the rough skin. Steller says that he found some of the holes made by the small crab-like crustacean *Cyamus* to ooze a thin serum.

These giant sirenians, the only Recent members of their order adapted to cold waters, had a brief and tragic history of discovery followed by swift extermination; however, they were probably already reduced by nature to a small relict population of a once widely-dispersed creature, as they were apparently confined in range to a few tiny, bleak islands in the Bering Sea. All that we know about their habits comes from Steller's account. They were quite numerous in the shallow bays and inlets around the coast of Bering Island when first discovered. They fed upon the kelp beds and the extensive growths of various marine algae which grew in the shallower waters. They were slow moving, utterly fearless of man, and were said to be affectionate toward each other, as they apparently tried to aid other individuals that were either wounded or in distress.

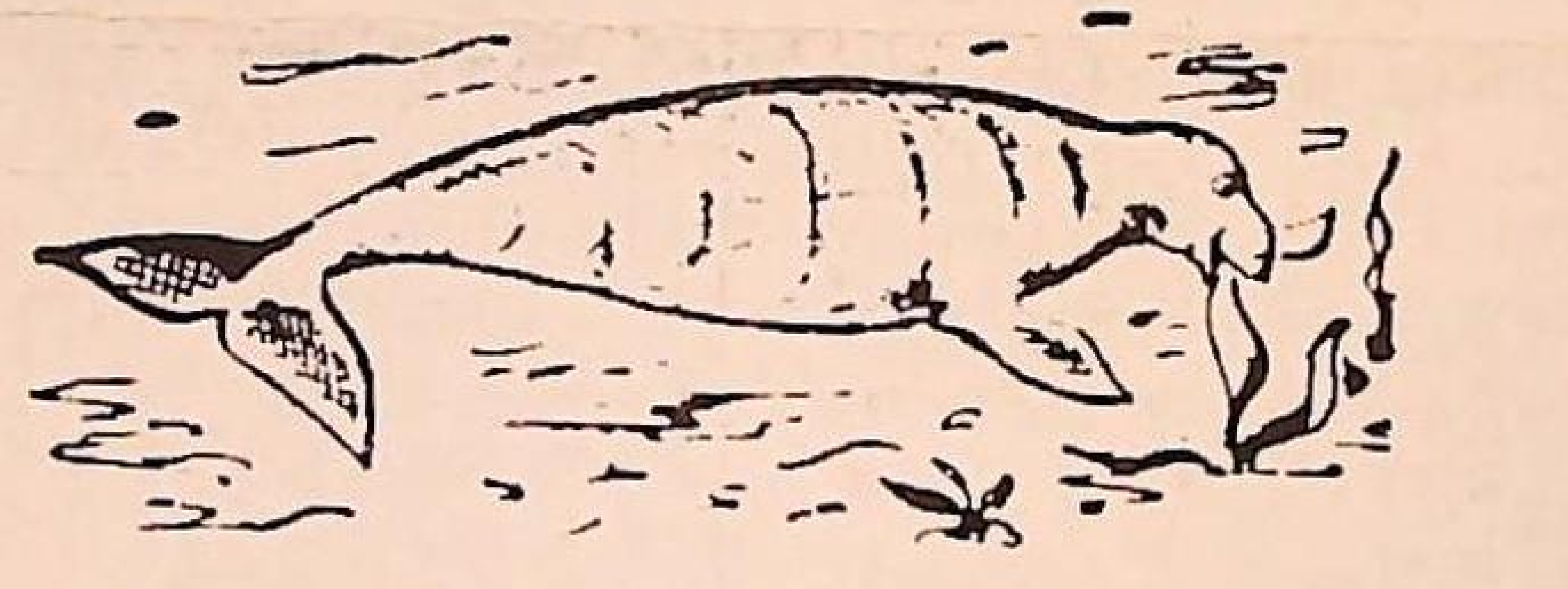
The following are excerpts from Steller's own account:

> Usually entire families keep together, the male with the female, one grown offspring and a little, tender one. To me they appear to be monogamous. They bring forth their young at all seasons, generally however in autumn, judging from the many new-born seen at that time; from the fact that I observed them to mate preferably in the early

ГДЕ ВЫ, КОРОВА СТЕЛЛЕРА?..

— Знаешь, — рассказывает Иван Никифорович Чечулин, киномеханик Карагинской агиткультбригады, — летом 1970 года я работал на лососевой путине в Анапкинской бухте. Бригада колхоза «Тумгутум» опытная, из местных жителей корянов-олюторцев. Каждый с детства рыбачит. Рыба шла хорошо.

Однажды после сильного шторма увидели мы на приливной полосе невиданного зверя: кожа темная, хвост раздвоенный, как у кита, передние конечности — ласты. Под кожей угадывается несколько округлых ребер. Подошли, потрогали — удивились: голова необычной формы, морда вытянутая. Никто из нас никогда не видел такого животного.



— Может, это была нерпа, лахтак или сивуч? — спрашиваю я полушутя-полусерьезно.

— Ты что? — обиделся Чечулин. — Не знаем, что ли? Каждый из нас сотни раз на охоту ходил. Нерпичий жир для береговых коряков — нымылан — лучшая приправа для юколы и толкуши. Всех морских зверей хорошо знаем.

Я показываю Ивану Никифоровичу рисунки морской коровы, животного, описанного впервые в 1741 году на Командорских островах выдающимся натуралистом Георгом Вильгельмом Стеллером. Животное это — морская корова — в настоящее время так и называется: морская корова Стеллера.

...— Точно такая же, — разглядывает рисунок И. Н. Чечулин. — И хвост, и передние ласты, и голова... Что от нее сейчас не осталось? — интересуется он.

— Ни одной... — Отвечаю. — Жаль...

В [illegible] году в Усть-Пахачинской школе был создан краеведческий музей.

За несколько лет юные краеведы собрали большой материал, в том числе и палеонтологический.

Ученые ТИНРО заинтересовались двумя школьными экспонатами — это были кости морских животных. Позже результаты изучения были опубликованы ими в газете «Камчатская правда», где ученые отметили, что одна из костей оказалась костью морской коровы, погибшей около 10 лет тому назад.

— Неужели корова Стеллера?.. Быть может, она действительно где-нибудь сохранилась, изменила образ жизни, живет среди стадных животных — лахтаков, морских котиков?

Пока факты свидетельствуют о другом. Корова Стеллера была уничтожена зверобоями за короткий срок. Обитающая в лагунах, на мелководье, где она питалась водорослями и морской травой, корова Стеллера была реликтовой, вымирающей.

Мясо ее, в отличие от других ластоногих, питающихся рыбой, по вкусу превосходило говядину, жир обладал прекрасными вкусовыми качествами, был низкоплавким, хорошо усваивался.

В настоящее время череп морской коровы Стеллера экспонируется в нашем музее. Полный скелет этого животного хранится в Хабаровском краеведческом музее.

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Владимир МАЛЮКОВИЧ,
старший научный сотрудник Камчатского областного краеведческого музея

Рисунок автора.

– Kamchatsky Komsomolets Copy

January 1977?

Where are you, Steller 's sea cow?

(Kamchatsky Komsomolets, Petropavlovsk, Janvier 1977)

"You know,"- told me once Ivan Nikiforovich Chechulin, projectionist of the Karaginskaya culture and propaganda team - " in summer 1976, I took part in some operations during the salmon fishing season in the Anapkinskaya Bay. A team of sealers of the collective farm " Tumgutum " consisted of the local population, namely koryaks and Olutorsky Gulf inhabitants. Everybody took part in the fishery from their childhood. During this season fish performed their downstream migrations by dense stocks.

Once, just after a heavy storm we noticed an unknown animal on a tidal belt, its skin was dark, its tail was forked like that one of the whale, the extremities of the animal were flippers. There were slightly noticed outlines of some round ribs. We approached the animal, touched it and were surprised as its head beared an unusual form and its snout was long. Non of us has never seen this animal. "Perhaps, it was a small seal or a bearded seal, or a Steller 's sea-lion?" -asked me half-serious, half in joke. "You don't say that,"-Chechulin felt hurt. "Dont we know? Every of us took part in the sealing hundred times. Small seal's blubber called by the local population "nymilan" is the best seasoning to "yukola"(local word for the dried and cured salmon) and"tolkusha"(also a local word). All marine animals are known to us".

I showed several drawings of the Steller's sea cow to Ivan Nikiforovich, the animal whose description was firstly given in 1741 found on the Commander Islands by an eminent naturalist George Wilhelm Steller. Presently, this animal, the sea cow, bears the name of the Steller's sea cow. "Just the same thing, -said I.N.Chechulin examining the picture.-The same tail, the fore flippers and the head ...Aren't they left now? - he asked surprised."Not a single one", answered me.-"Though.! In 1966, a Museum of local lore was created in an Ust-Pakhachinskaya school.

During some years young students of local lore collected large volume of data including palaeontological one.

TINRO scientists became interested in two school exhibits, those were bones of some marine animals. Later on, the scientists published the results of their investigations in a newspaper " Kamchatskaya Pravda " where they paid their attention to the fact that one of those bones appeared to be a bone of a sea cow died about 10 years ago.

Can it really be true a Steller's sea cow?...Perhaps, this animal was kept in reality somewhere and changed its mode of life, and even lives among the herd animals, namely, among bearded seals and fur seals? For the present, the facts testify to another thing. The Steller's sea cow was fired out by hunters throuout a short term. Inhabiting lagoons in the ashore waters, where it fed on sea algae and eel grass, the Steller's sea cow was a relic and dying animal.

And its meat exceled beef by taste in contrast to other pinnipeds fed on fish, its fat was delicious, low fusible and well assimilated.

Presently, the skull of the Steller's sea cow is exposed in our Museum. A complete skeleton of the animal is kept in Khabarovsk Museum of local lore.

Kamchatka is studied insufficiently in biological and geographical aspects. There can be found hundreds of areas in our country seldom visited by people and where marine mammals can inhabit easily including the Steller's sea cow. These areas are lagoons, estuaries, lakes with warm water open to the sea.

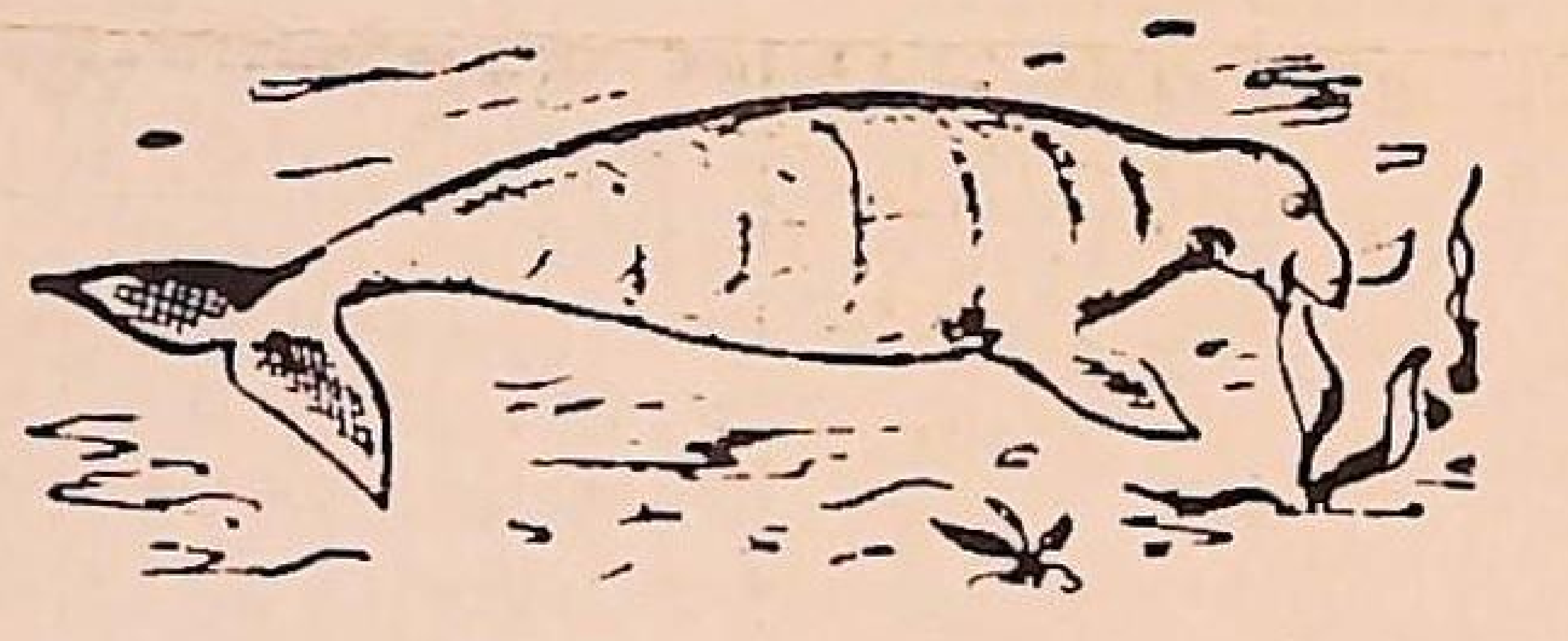
The opinion of the scientists can not be considered as a stable one for always. Let it be yet considered that the Steller's sea cow has died out. But ... to prove it finally, it is necessary to organize a special expedition. There is need to organize a great biological expedition which could start its work already in summer months 1977 throughout all regions of the Kamchatka area with application of the method elaborated by the scientists of the Kamchatka Branch of TINRO.

Undoubtedly, the youth of our area will take an active part in these investigations.

Vladimir Malukovich,
senior scientific worker,
Kamchatka Museum of local lore.

и детства рыбачил. Рыба шла хорошо.

Однажды после сильного шторма увидели мы на приливной полосе громадного зверя: кожа толстая, хвост раздвоенный, как у кита, передние конечности — ласты. Под кожей угадывается несколько округлых ребер. Подошли, потрогали — удивились: голова необычной формы, морда вытянутая. Никто из нас никогда не видел такого животного.



— Может, это была нерпа, лахтак или сивуч? — спрашиваю я полушутя-полусерьезно.

— Ты что? — обиделся Чечулин. — Не знаем, что ли? Каждый из нас сотни раз на охоту ходил. Нерпичий жир для береговых коряков — нымылан — лучшая приправа для юколы и толкуши. Всех морских зверей хорошо знаем...

Я показываю Ивану Никифоровичу рисунки морской коровы, животного, описанного впервые в 1741 году на Командорских островах выдающимся натуралистом Георгом Вильгельмом Стеллером. Животное это — морская корова — в настоящее время так и называется: морская корова Стеллера.

краеведческий музей.

За несколько лет юные краеведы собрали большой материал, в том числе и палеонтологический.

Ученые ТИНРО заинтересовались двумя школьными экспонатами — это были кости морских животных. Позже результаты изучения были опубликованы ими в газете «Камчатская правда», где ученые отметили, что одна из костей оказалась костью морской коровы, погибшей около 10 лет тому назад.

— Неужели корова Стеллера?.. Быть может, она действительно где-нибудь сохранилась, изменила образ жизни, живет среди стадных животных — лахтаков, морских котиков?

Пока факты свидетельствуют о другом. Корова Стеллера была уничтожена зверобоями за короткий срок. Обитающая в лагунах, на мелководье, где она питалась водорослями и морской травой, корова Стеллера была...

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Рисунок автора.

Arthur C. Clarke's Simon WELFARE and John FAIRLEY: (London, Grafton Books, 1989)

the sightings round the British Isles now seem ascribable to the wonderful leathery turtle. This huge creature, as big as a mini car and weighing perhaps 800 lb (360 kilos), now seems to be more common in British waters than was previously thought, for it is born thousands of miles away in the Caribbean or even Malaysia. Virtually nothing is known of its journeys across the oceans, but it seems unlikely that it would intentionally venture into the chilly waters of the North Atlantic.

In 1985, however, another great leathery turtle came ashore near Mousehole in Cornwall. It was nearly 7 ft (2.5 m) long and weighed just under 7 hundredweight. It had apparently choked on a plastic bag, mistaking it for the jelly fish which are its principal food source. Many of the descriptions of classic British sea monsters, such as the Soay monster, suggest the leather back turtle as a convincing explanation. But no one has yet proposed a satisfactory solution to the traditional sea monster with horse's head and humps, which has been seen by seamen and shore watches all over the world and seems as common as ever.

At least six people saw the Stinson Beach monster north of San Francisco one afternoon in October 1983. Matt Ratto was a member of a construction crew working on the highway. They had binoculars which were apparently used for observing frolics on the beach during their lunch breaks. However, this time they were at hand for more serious viewing when one of the crew called up on the two-way radio and told Ratto to look out to sea. The mystery animal was only 100 yards off shore and about a quarter of a mile away when Ratto focused on it. It was being followed by a large flock of birds and about two dozen sea lions. Ratto and his fellow crew members all agreed that the creature was about 100 ft (30 m) long – they had the sea lions with which to compare it. Ratto said: 'There were three bends like humps and they rose straight up. Then the head came up to look around.' Truck driver Steve Bjora thought it looked like a huge eel. 'The sucker was going 45 to 50 miles an hour. It was clipping. It was boogeying.'

Safety inspector Marlene Martin of the California Department of Transport apparently told her family it was the biggest thing she had ever seen in her life: 'It made Jaws look like a baby.' A teenager on the beach below, Roland Curry, also saw the animal, and reported that it was his second sighting within a week. The first time, it was visible for only about thirty seconds and the head came up for a couple of seconds before the animal dived. Later the same week a surfer, Young Hutchinson, reported that a sea serpent had surfaced within 10 ft (3 m) of his surfboard off the Santa Ana River: 'At first I thought it was a whale, but I've seen a lot of whales and it didn't look the same at all. The skin texture wasn't the same and there were no dorsal fins. In fact it was like a long black eel. It was really moving. We got the hell out of there and paddled for the shore.'

The local scientists all offered the usual explanations of pilot whales and porpoises in a line jumping from the water. But these do not seem adequate for a creature viewed for some time by a group of people, one of whom had binoculars, and then at very close quarters by an apparently level-headed surfer. In the chronicles of sea monsters, Stinson Beach, 1983, seems a hard one to explain away.

A more enigmatic recent report comes from Iceland. Two bird-watchers, Olafur Lafsson and Julius Asgeirsson, were on the beach twenty miles north of Reykjavik, when they saw two creatures emerging from the sea and gambolling about on the beach. Asgeirsson said: 'They were larger than horses, they moved about like dogs, but they swam like seals.' The animals soon went back into the water, leaving behind tracks in the sand. 'The footprints were larger than those of horse hoofs and split like those of a cloven-footed animal, but with three cloves instead of two.' No explanation beyond the shrouded visions of the old Icelandic sagas has yet appeared.

One putative source for the eel-like sea monster has been thoroughly discredited by recent research. Over the last century a few examples of giant eel larvae have been trawled out of the oceans. One captured by the round-the-world *Dana* expedition in 1930 was nearly 6 ft (2 m) long. Comparisons with other eel larvae suggested that it might grow into a serpent of mammoth proportions if it progressed in similar fashion. There was speculation about giant eels of up to 150 ft (45 m), which might well fit the bill as sea monsters. However, Dr David Smith of the University of Texas has shown that not only do the giant eel larvae not go on growing, they actually get shorter when they transmute into a fish, becoming spiny eels of only 2 or 3 ft (60 to 90 cm) in length.

Mermaids and giant eels have receded in recent years; the giant octopus seems a little closer; but the regular surprises, from the coelacanth to the megamouth, indicate that the huge, barely explored territories of the great oceans are well capable of retaining many secrets even in the age of high-powered submarine technology.

Arthur C. Clarke comments:
A few years ago an oil company engineer passing through Sri Lanka told me a story which makes a splendid sequel to our programme 'Monsters of the Deep' (Chapter 4 of *Arthur C. Clarke's Mysterious World*).

Everyone must have seen pictures of the enormous oil-rigs which are used for ocean drilling; some of them are as big as skyscrapers. Well, it seems that one of these rigs had a problem. The divers couldn't go down to inspect it because it was covered by an octopus! I could not discover exactly – or even approximately – what percentage of the rig was so ornamented. Of course, objects are magnified under water, and the first diver down probably did not stop to make accurate measurements.

As an inoperative rig costs a few hundred thousand dollars a day in lost revenue, the oil company, sadly but understandably, did not call for marine scientists to come and examine this splendid specimen whenever it was convenient. They shooed it away with carefully calibrated underwater explosions – without, I hope, giving it a headache.

Some new light has also been thrown on the giant squid (genus *Architeuthis*). These creatures of the deep apparently cannot survive long in warm waters because their blood will not transport oxygen efficiently at more than 10°C. So if you ever meet one on the surface in tropical waters (*vide* the chapter 'Squid' in *Moby Dick*), it is almost certainly dying. I would not suggest that even the most ardent conservationist attempt mouth-to-beak resuscitation.

Turning to less fearsome sea monsters (not that I would care to meet one when snorkling peacefully along the reef), I am grateful to Michel Raynal of Narbonne, France, for an item about the possible survival of Steller's sea cow. The translation is so delightful that it would be a pity to correct it:

Where are you, Steller's sea cow?*

translation made by a Soviet scientist

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> Once, just after a heavy storm we noticed an unknown animal on a tidal belt, its skin was dark, its tail was forked like that one of the whale, the extremities of the animal were flippers. There were slightly noticed outlines of some round ribs. We approached the animal, touched it and were surprised as its head beared an unusual form and its snout was long. None of us has ever seen this animal.
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> 'Perhaps, it was a small seal or a bearded seal, or a Steller's

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* *Kamchatsky Komsomolets*, Petropavlovsk, January 1977.

sea-lion' – asked me half-serious, half in joke. 'You don't say that,' Chechulin felt hurt. 'Don't we know? Every one of us took part in the sealing hundred times. Small seal's blubber called by the local population "nymilan" is the best seasoning to "yukola" (local word for the dried and cured salmon) and "tolkusha" (also a local word). All marine animals are known to us.'

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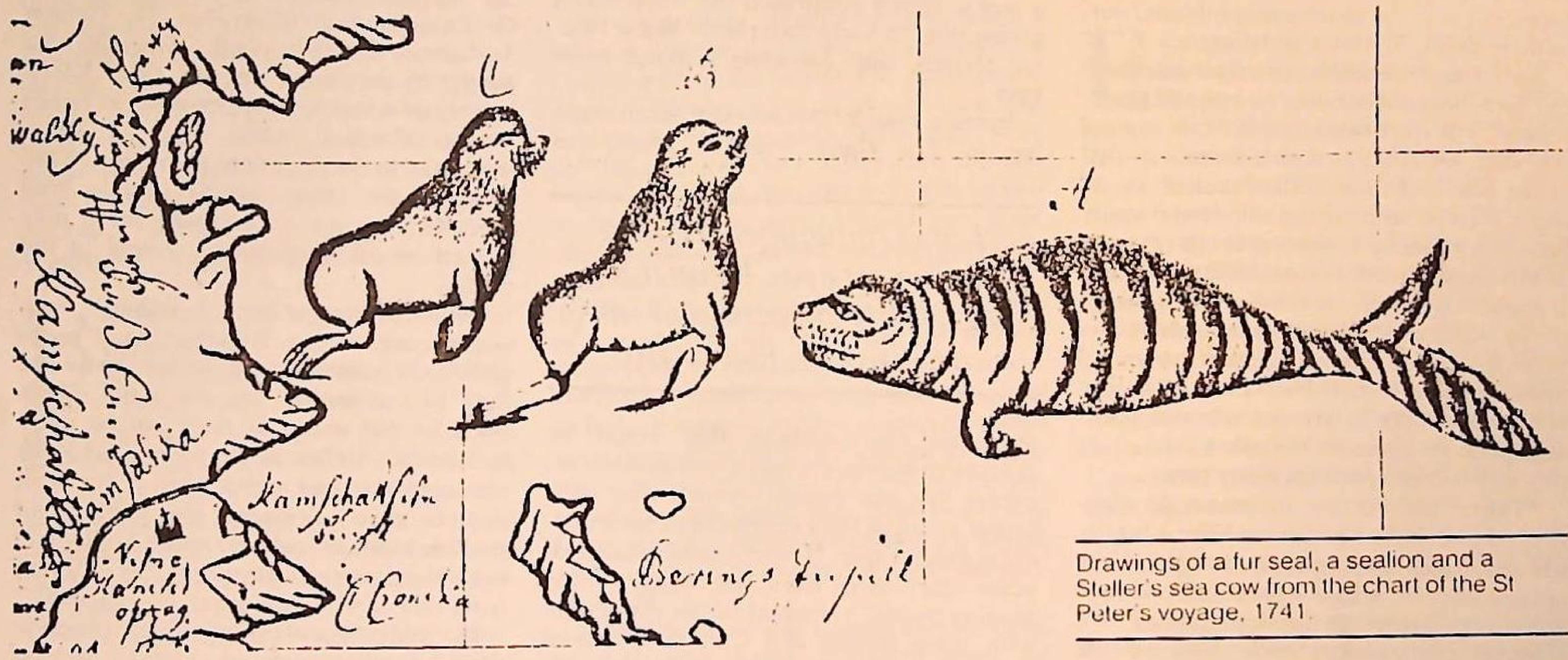
VLADIMIR MALUKOVICH,
senior scientific worker,
Kamchatka Museum of Local Lore.

Salty Tales

There's nothing like the seven seas for an abundance of unknown animals. Some of these have been popping up ever since man became a mariner. Others have been sighted once or twice and never again. But each kind has its own strange credibility. Here, Miles Clark tells the story of the twice-seen Steller's sea monkey, and on page 13 Michael Bright reviews the latest observations of the ages-old and ubiquitous sea serpent.



Drawings of a fur seal, a sealion and a Steller's sea cow from the chart of the St Peter's voyage, 1741

> ‘. . . making such motions and monkey tricks that nothing more laughable can be imagined.’

If you were to open an atlas and search for an area in the northern hemisphere where it's possible that a large mammal could either have evaded discovery or might wrongly have been considered extinct, your finger might well fall on the Aleutian Islands—the longest archipelago on the globe, spanning more than 1,200 miles from mainland Alaska to Siberia's Kamchatka peninsula. The islands are the emergent volcanic peaks of a vast mountain range that rises nearly 30,000 feet from the floor of the North Pacific Ocean.

Inaccessibility and severe weather have combined to deter all but the most hardy and dedicated scientists from working in the Aleutians. In winter, winds of 120mph, which can lift driftwood logs 30 feet into the air, are not uncommon. Comprising more than 200 islands, the chain forms one of more than 400 National Wildlife Refuges scattered throughout the United States, administered by the US Fish and Wildlife Service. Tufted puffins, auklets, terns and fork-tailed petrels are among the species of the more than five million birds that come to the Aleutians each year to breed.

These misty islands were discovered in 1741 by the Danish explorer Vitus Bering, who was leading a Russian expedition in the ships *St Peter* and *St Paul*. On board Bering's ship was Georg Wilhelm Steller, a brilliant young naturalist, who made meticulously detailed notes on the new species of flora and fauna that he observed during the voyage. Many of Alaska's plants and animals still bear his name.

On its homeward passage, Bering's ship was wrecked on Attu, the westernmost island in the chain. Those members of his crew who didn't die of exposure managed to stay alive by harpooning and eating vast sea animals—up to 30 feet long—which were feeding in the kelp around the islands. These huge mammals, members of the Sirenia family—which today includes the manatees and the dugongs, all rare or endangered—became known as Steller's sea cows.

Over the past 20 years there have been various reported sightings of the sea cow off the western Aleutians and Kamchatka. The descriptions are intriguing, but it is very possible that the animals were whales, or walruses, which only seldom venture as far south as the Aleutians. Although some Russian authorities believe that the Steller's sea cow could have survived, most zoologists remain firm in their conviction that these vast creatures reached extinction in 1768, when the first Russian fur traders came to hunt the sea otter. (In Steller's day, almost every island was inhabited by the Aleut people, a race that may once have numbered as many as 15,000. Today however, only a few hundred survive; Atka in ▷

(Bristol)

the central Aleutians, with a population of around 120, is the most westerly settlement in North America.)

Less well known, however, is another animal which was observed on those early voyages of discovery. During the outward passage, the ships sailed south of the Semidis, a group of islands in the east-central Aleutians. Shortly before sunset on 10 August 1741, Steller's eye was attracted by "a very unusual and unknown sea animal," which appears to have borne no resemblance to any surviving marine mammal:

"It was about two Russian ells (five feet) in length and the head was like a dog's, with pointed erect ears. From the upper and lower lips on both sides whiskers hung down, which made it look almost like a Chinaman. The eyes were large; the body was longish, round and thick, tapering gradually towards the tail. The skin seemed thickly covered with hair of a grey colour on the back, but reddish white on the belly; however in the water, the whole animal appeared red like a cow."

Later he wrote: "Nothing struck me as more surprising than the fact that neither forefeet (as in the marine amphibians) nor, in their stead, fins were to be seen."

Steller and the ship's crew were intrigued by "its wonderful actions, jumps and gracefulness. For over two hours it swam around our ship, looking, as with admiration, first at the one and then at the other of us. At times it came so near the ship that it could have been touched with a pole, but as soon as anybody stirred it moved a little farther. It could raise itself one third of its length out of the water exactly like a man, and sometimes it remained in this position for several minutes. After it had observed us for half an hour, it shot like an arrow under our vessel and came up again on the other side . . . in this way it dived perhaps thirty times.

"There drifted by a seaweed, club-shaped and hollow at one end like a bottle, towards which, as soon as it was sighted, the animal darted, seized it in its mouth, and swam with it towards the ship, making such motions and monkey tricks that nothing more laughable can be imagined. After many jumps and motions it finally darted off and did not appear again. It was seen later, however, several times in different places of the sea."

No record of any other sighting of this animal has been found, and so scientists have generally agreed that it must have become extinct at around the same time as the sea cow. That was until 1965, when Brigadier Miles Smeeton—a distinguished British author, yachtsman and adventurer—sailed through the Aleutian Islands in his 46ft ketch *Tzu Hang*, the first yacht to make this passage. On board were his wife Beryl, his daughter Clio and Henry Combe. On a clear afternoon in June, they were sailing about four miles off the northern coast of Atka, in the central Aleutians, bound for Deep Cove, when they saw a strange animal which they couldn't identify. Neither the Smeetons nor Henry Combe had read a detailed history of Bering's voyages; yet there is an uncanny similarity between this sighting and the animal that Steller had observed more than 200 years before.

"Close off the port bow," wrote Miles Smeeton, "an animal was lying in the water; it looked to be about the size of a sheep with long pepper-and-salt hair like a cairn terrier, of a reddish-yellow colour. As the bow approached, it made a slow undulating dive and disappeared beneath the ship. What most impressed me was the length of its hair, about four to five inches long; and when I first saw it on the surface, the hair was floating round the body like weed growing on a half-submerged rock."

Miles Smeeton never saw the animal's head, but Clio, who saw it surface on the other side of the yacht and look at them, said that the head was more like the head of a dog than of a seal, with the eyes close together, not set on the side of the head like a seal's. Henry confirmed this impression, saying that "it had a face rather like a Tibetan terrier, with drooping Chinese whiskers."

In more than 50,000 miles of ocean cruising in *Tzu Hang* over 15 years, the Smeetons saw nothing that could be described as mysterious or unaccountable, except this one animal—which they soon forgot about in the excitement of their arrival at Deep Cove. It wasn't until nearly two years after their Aleutian voyage, while reading Steller's account of his expedition with Vitus Bering that Clio remembered their own sighting and wrote from South Africa to remind her father.

'I also remember its dark intelligent eyes. I saw it for about 10 to 15 seconds. I never saw any legs, feet or fins.'

Steller called this animal the sea monkey, presumably because of its monkey tricks as it frolicked around his ship, and only one other reference to it—quoting Steller's account—appears to have been made. In 1981, I took a six-strong Cambridge expedition to Atka, to carry out limited geographical and archaeological research and, at the same time, investigate the possibility that this endearing animal might survive. None of the specialists I spoke to in Alaska were able to suggest a simple explanation.

Professor Ted Bank, a veteran of more than 30 years of research in the Aleutians, recalled a fisherman mentioning that in 1978 he had seen a "reddish-coloured hairy creature" off the island of Unalaska in the eastern Aleutians. On this occasion, when the animal came closer it was positively identified as a red-coloured sea otter. The fur of the California sea otter is known to vary from dark brown through to brick red, and adults can occasionally grow to between four and five feet long, but the Smeetons are quite certain that this was not an otter. "We often saw large numbers of sea otters close inshore, where they were feeding in the kelp beds," recalls Miles, "and they often came quite close around the boat. But we never saw them as much as four miles offshore."

From the start, its name alone—the sea monkey—raises eyebrows and invites scepticism. Perhaps for this reason, the Aleuts on Atka—who are very conscious of how the outside world regards them—were understandably wary of any interest shown in a mysterious animal around their shores. Had they seen anything unusual, it is highly unlikely that they would have mentioned it to us.

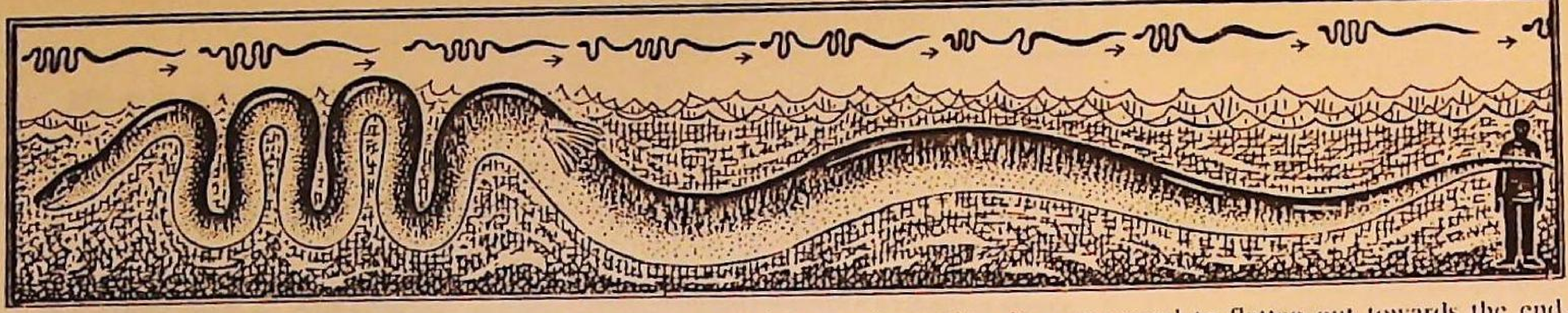
Rudyard Kipling wrote a tale about the "white seal" in waters of the North Pacific, and in 1984 Samuel Goldwyn made a fiction film, *The Golden Seal*, about a small boy in the Aleutians who befriends the animal of the title. Based loosely on a legend heard by novelist James Vance Marshall while working as a deckhand in the Aleutians at the turn of the century, the story doesn't exactly lend credibility to the theory that there may indeed be an unidentified animal in the chain.

Steller's biographer, Leonhard Stejneger, concluded in 1935 that "in all probability the animal which Steller saw in the light of the setting sun was a full grown bachelor fur seal... It must not be overlooked that Steller, at the time he made his observations, had never seen a fur seal, dead or alive." Stejneger also pointed out that the kinds of seal with which Steller had been familiar until then were "as different from that of a fur seal as can be imagined."

But in the light of his subsequent observations of other seals in Alaskan waters, wouldn't Steller have referred back to his previous notes about the sea monkey if he had come to accept it simply as a new species of seal? Steller was undoubtedly an argumentative and impetuous individual, a difficult man to get on with on a long passage, but he was also a very accurate and literal observer.

Henry Combe, who was on board *Tzu Hang* with the Smeetons, has always been certain that they saw something "completely strange that day."

"It was misty, but clear around *Tzu Hang* that morning. The sea was flat calm. I saw the animal from a distance of, at most, 10 feet. It was lying in the water with its head cocked up looking at me. My mother had a Tchitzu Tibetan terrier at the time, and I



Andy Martin

reported by locals and holidaymakers.

Off the Welsh coast between 1970 and 1975, an animal with a huge body and a snake-like head and neck was seen by fishermen, yachtsmen, hotel keepers and a group of six children.

At Helensburgh, a Scottish seaside resort, a man and his dog were scared out of their wits by a 40-foot-long creature which slithered from the beach and disappeared into the Clyde estuary. And unidentified swimming objects have been spotted off Skegness, Mudeford, North Uist and the South Devon coast.

Along the Pacific coast of Canada, 23 observations of large, long-necked sea creatures are included in a report compiled by Paul Leblond and John Sibert of the University of British Columbia. At Chesapeake Bay on America's east coast, the Enigma Project has collected together all the sightings of 'Chessie', a large, snake-like marine animal that—despite being captured on film and video and thereby analysed by the prestigious Smithsonian Institution in Washington—still remains unidentified.

But perhaps the most extraordinary sightings have taken place close to San Francisco, California. In September 1976, Tom D'Onofrio and Dick Borgstrom were on Agate Beach at the nearby town of Bolinas when a 60-foot-long sea serpent rode in on a wave and "gambolled" in the surf. Seven years later, a road construction crew, working on a cliff-top highway to the south of Stinson Beach, saw the same sort of sight.

"It was coming right at us, real fast," recalls safety engineer Marlene Martin. "There was a large wake on the surface and the creature was submerged about a foot under the water. At the base of the cliff it lay motionless for about five seconds, and we could see it stretched out. I decided it must have been about 100 feet long, and like a big black hose about five feet in diameter.

"It then made a U-turn and raced back, like a torpedo, out to sea. All of a sudden, it thrust its head out of the water, its mouth went towards the sky, and it thrashed about. It coiled itself up into three humps of the body and started to whip about like an uncontrolled hosepipe. It did not swim sideways like a snake, but up and down.

"I had the binoculars and kept focused on the head. It had the appearance of a snake-like dinosaur, making coils and throwing its head about, splashing and opening its mouth. The teeth were even—there were no fangs. It looked gigantic and ferocious."

What the animal was doing in the shallows was not clear, although Martin had seen sealions and seabirds in the area before it arrived. After the event, all the wildlife disappeared for the rest of the day.

Seals or sealions were also in evidence before an even more remarkable sighting by the Clark twins early in the morning of 5 February 1985. They were sitting in their car just 10 yards from the seawall on the waterfront at Marina Green beside San Francisco Bay. The tide was high, the sky blue and the visibility good. William Clark was in the driver's seat.

"I was looking directly in front when I noticed four or five seals, swimming at a fairly rapid speed, about 150 yards away. They suddenly made an abrupt turn and headed for the seawall. Two seals were moving extremely fast. After a few seconds I saw a wake slightly to the rear of these two seals and looking closer I could see a large black snake-like animal swimming rapidly after the seals."

"The shape was definitely that of a snake or an eel, and the head was visible as it swam perhaps only a foot under the water. Behind the head I could see what appeared to be four humps, and the animal appeared to be propelling itself by wriggling in a vertical manner. A series of four coils was created at the front half of its body, and these travelled backwards along the length of the neck where they would meet the middle body.

"At this point the undulations stopped abruptly and slowly dissipated along the remaining part of the body, which was dragged behind. There would be a short pause and another series of coils would begin. What made it even more astonishing was that this was all happening at a very high speed."

About 20 yards from the seawall the animal emerged and corkscrewed around, allowing the brothers to see many of its features. It was not furry but had large "round or hexagonal scales" and looked "oily or slimy". The head, neck, and dorsal part of the body were a dark brownish green, while the underbelly was a lightish yellow green.

The head was like that of a snake and a little wider than the neck. The neck behind the head was about 10 inches in diameter. The main part of the body was about three feet across and the tail was long, and appeared to flatten out towards the end. The entire animal was estimated to be between 60 and 75 feet long.

It paused for a few seconds as if looking for the seals, and then twisted again so that its body was once more out of the water. It was then that the two meticulous observers, both ex-Eagle Scouts, noticed at the side of the body two pairs of translucent fan-like fins, which appeared to act as stabilisers. Robert Clark kept his eye on one of the fins.

"It was triangular in shape. It had a paper-thin membrane between the ribs. The appendage looked as if it folded and unfolded like a fan, and was flexible. The membrane appeared to be a light grassy green and the ribs a mossy green."

Eventually the creature, moving with undulations of the neck, headed for deeper water and disappeared. Robert and William continued to watch for half an hour and then telephoned the coast guard. Later, before a notary public, they wrote down their observations and sent them to the International Society of Cryptozoology. Marine biologist and ISC board member Forrest Wood was puzzled.

"Taking the descriptions at face value," he wrote, "we can identify it as vertebrate, but beyond that its features become contradictory. No known fish or aquatic reptile swims with vertical flexions of the body. Cetaceans, sirenians and true seals do flex their bodies in the vertical plane, but their flexions are modest, and they are quite incapable of forming humps or 'coils' such as those described.

"The scales, slimy appearance, and pairs of rayed fins could belong only to a bony, ray-finned fish. With the exception of seahorses and some of their relatives, no fish has what could be called a neck. In all cases, cervical vertebrae are lacking; neck movement is impossible.

"On the basis of zoology, including palaeontology and phylogenetic principles, it is an impossibility." ☐

RADIO LINK

You can hear a wide selection of recent eyewitness accounts of large unidentified swimming objects, together with an analysis of the sightings by cryptozoologists and marine biologists, in The Great Sea Monster Mystery, *produced by Michael Bright, at 11pm on Thursday 1 January, Radio 4 (repeated from Saturday 27 December).*

remember I was struck by the resemblance. The head seemed very small in relation to the body but that may have been because all the hair was floating out from it.

"The hair was, as I remember sort of palish grey with a mangey tinge to it. It formed a distinctly dark, straight 'parting' all down the animal's back. It's strange but I cannot really recall its size—my impression seems to be that it was about five feet long but I feel somehow that it was less. I think is just appeared much bigger because of all the surrounding hair.

"I also remember its dark intelligent eyes. I saw it for about 10 to 15 seconds. I never saw any legs, feet or fins. We saw seals enough for me to state quite categorically that what I saw was no seal. One thought which has occurred to me was that it might have been a sea otter with a strange coat, perhaps a mutation. Perhaps he had something wrong with him, perhaps he was very, very old, I don't know. I saw lots and lots of sea otters and certainly this was very different but, perhaps . . . who knows?"

There is just one other possible explanation. Jay Ellis Ransom, who was for many years executive director of the Aleutian-Bering Sea Expeditions Research Library in Oregon and who first visited the Aleutians in 1936 to learn the Aleut language, firmly believes that there is no such thing as the sea monkey.

"The original animal," he suggests, "was almost certainly a wayward Hawaiian monk seal." These animals are generally confined to the atolls and islands which stretch northwest from the main Hawaiian archipelago, nearly two thousand miles south of Atka.

Like the sea otter, the monk seal was hunted almost to extinction for its oil and hides, but as a southern species of hair seal, it never inhabited Aleutian waters—other, perhaps, than a single wandering animal. Today, the 700 or so surviving Hawaiian monk seals *Monachus schauinslandi* breed on Pearl Reef and Hermes Reef and a number of other small islands in the Hawaiian group; 20 years ago they were also found on Midway and Kure, a hundred miles farther north, less than 1,500 miles south of the Aleutians.

Monk seals have been known to grow to over six feet from nose to tail and can weigh up to 550lb; both adults and pups have a silvery grey belly with a darker slate grey back. Occasionally they may range widely from their Hawaiian breeding grounds—one was found 1,105km to the south-west of the archipelago—but they generally stay in the warm waters south and west of Hawaii.

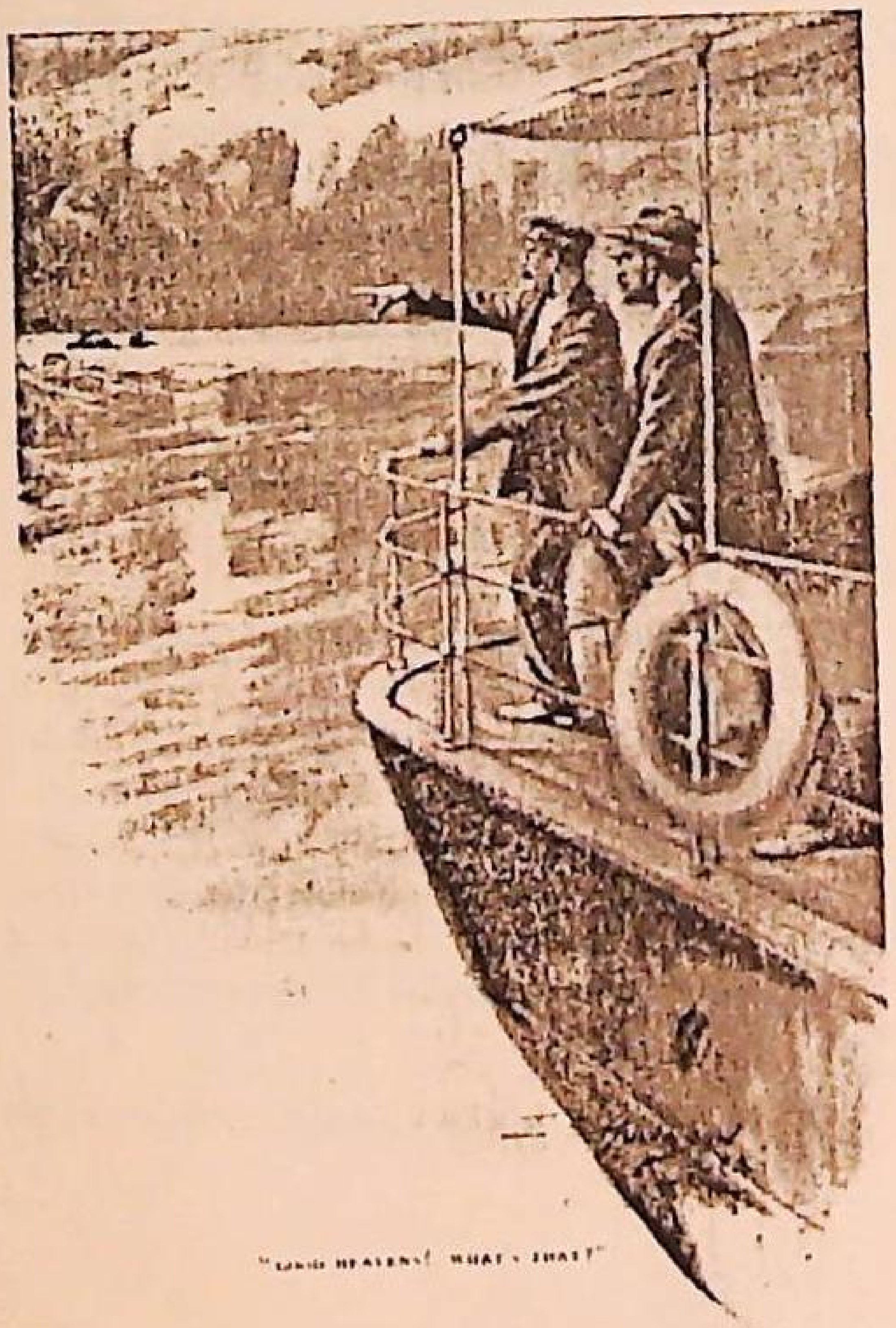
Mature monk seals may develop a growth of green algae on their fur, possibly as a result of spending a considerable time at sea. The adults moult during the summer, but in order to aid heat loss in tropical waters, the hairs of their coats are short—and none of them seems to fit the descriptions of the animals seen by Steller and the Smeetons and Henry Combe.

But for the moment, the sea monkey still lives in the realm of the nessies and the yetis and all the other almost-animals, waiting to be rescued from sceptical laughter by true scientific discovery. □

Miles Clark is a freelance writer and photographer. He was a member of the first successful team, as part of Operation Drake, to retrace the route taken by Bilboa in 1513 across the isthmus to the Pacific Ocean, has led an expedition to the Aleutian Islands, and was a member of the Jason expedition which, aboard an ancient Greek galley, attempted to establish whether there could have been an historical basis to the legend of Jason and the Argonauts.

He is a recipient of the Scientific Exploration Society's Young Explorer of the Year Medal, has served on the Policy Advisory Council of the Operation Drake Fellowship and is a fellow of the Royal Geographical Society.

Salty Tales *II*


"GOOD HEAVENS! WHAT'S THAT?"

> ❛It coiled itself into three humps of the body and started to whip about like an uncontrolled hosepipe.❜

"The back of its head, sunk upon the shoulders, was visible, together with the twenty-five feet of the body which I have hitherto characterised as the hump of the back. As we gazed, the creature, without changing the position of its head or neck, lurched forward and downward . . . The tail, in all its long, undulating extension, did not rise in the air; it seemed merely to slide away, like a floating rope dragged downward by the sinking mass of body to which it was attached."

—Joseph Ostens Grey, second officer of the cargo-steamer *SS Tresco*, writing in *The Wide World Magazine*, 1903.

People have been seeing sea-serpents, and reporting them to unbelievers back home, ever since people have been going to sea. And through the ages there has been an uncanny consistency in the physical descriptions that the seafarers have brought back.

This could be because a sea-serpent convention developed—so much so that early maps were routinely adorned with the finned, undulating, dragon-like creatures—and any large and unidentifiable thing seen swimming in the water was immediately given all the sea-serpent trimmings.

Or it could be that there is such an animal. We don't know, and because we don't, the consensus remains strongly on the side of the first proposition—but sightings have not declined with the advent of the age of scientific scepticism, nor have the sighters, as a group, been shown to be more inclined than anyone else to hallucination, wild lying or drink.

Cryptozoologists—who, in studying the evidence of unauthenticated animals, are obliged to give them at least an even chance of existence—had expected that, in modern times, sightings would have dropped off—not necessarily because people today are more scientific or sober, but because noisy supertankers or container ships should, by rights, have frightened the monsters away.

But that doesn't seem to be the case either. Bernard Heuvelmans, president of the International Society of Cryptozoology (ISC) and author of *In the Wake of Sea Serpents*, has analysed the sightings of the past 150 years and has found that they have remained fairly steady. In the course of making *The Great Sea Monster Mystery* for Radio 4, I have just finished reviewing some of the more recent ones.

In Cornwall in 1976, the head and neck of *morgawr* (Cornish for sea monster) startled the crew of a small inshore fishing boat 25 miles south of the Lizard, and its brief appearances close to beaches and cliffs near Falmouth in 1975 and 1976 have been ▷